ARCHIVES OF OPHTHALMOLOGY

VOLUME 33 (old series Volume 90) JUNE 1945 NUMBER 6

COPYRIGHT, 1945, BY THE AMERICAN MEDICAL ASSOCIATION

TREATMENT OF BILATERAL RETINOBLASTOMA (RETINAL GLIOMA) SURGICALLY AND BY IRRADIATION

REPORT ON PROGRESS

HAYES MARTIN, M.D.
Attending Surgeon, Memorial Hospital for the Treatment of Cancer and Allied Diseases*

AND

ALGERNON B. REESE, M.D.
Ophthalmologist, Memorial Hospital for the Treatment of Cancer and Allied Diseases

NEW YORK

In 1936 we [1] described the technic of a new method of treatment for bilateral retinoblastoma, with reports on progress up to that date in the cases of 6 patients, all of whom had then been observed for less than five years. The principles of this method of treatment were: first, the surgical removal of one eye with the more advanced involvement, and, second, the treatment by fractionated roentgen irradiation of the remaining eye in an attempt to conserve vision. In 1942 we made a second report,[2] giving the follow-up observations in the previously recorded cases, adding 4 new cases and describing certain modifications in technic.

The purpose of the present communication is to present follow-up data in the cases previously reported and to record the results to date of the treatment in 14 additional cases, which make a total of 24 cases of bilateral retinoblastoma in which treatment was by this method. A short description of the technic will be repeated in this report, and we propose to discuss, further, the clinical course of retinoblastoma following radiation therapy, the relative importance of certain factors of technic and the apparent causes of certain complications of treatment.

* From the Head and Neck Service of the Memorial Hospital for the Treatment of Cancer and Allied Diseases.

Read before the Section on Ophthalmology at the Ninety-Fourth Annual Session of the American Medical Association, Chicago, June 14, 1944.

1. Martin, H., and Reese, A. B.: Treatment of Retinal Gliomas by the Fractionated or Divided Dose Principle of Roentgen Radiation, Arch. Ophth. **16**:733-761 (Nov.) 1936.

2. Martin, H., and Reese, A. B.: Treatment of Retinoblastoma (Retinal Glioma) Surgically and by Irradiation, Arch. Ophth. **27**:40-72 (Jan.) 1942.

END RESULTS TO DATE IN TWENTY-FOUR CASES OF BILATERAL RETINOBLASTOMA TREATED SURGICALLY AND BY IRRADIATION

In reporting end results in the treatment of cancer, we believe that a five year period of observation is generally accepted as being neces-

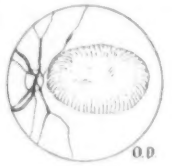
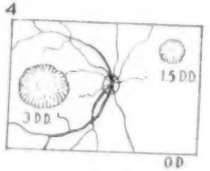
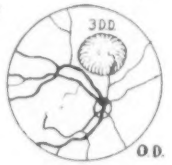
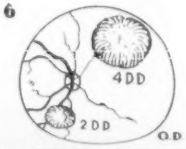
TABLE 1.—*Five Year End Results in Nine Cases of Bilateral Retinoblastoma Treated Surgically and by Irradiation Prior to July 1939*

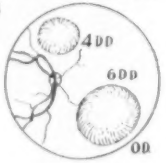
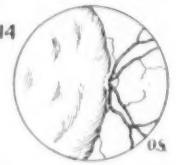
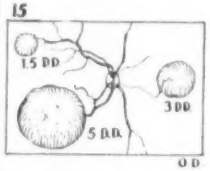
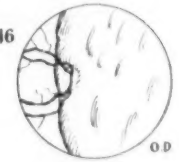
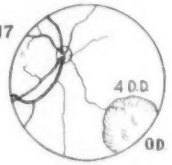
	No. of Cases
Total number of cases	9
Indeterminate outcome	
Death due to cause other than the tumor without recurrence of retinoblastoma	1*
Determinate results	
Total number of cases minus case with indeterminate outcome	8
Failures	
Death due to retinoblastoma	2
Five year end results (calculated on the basis of 8 cases with determinate results)	
Patient living without recurrence and with vision	2 (25%)
Patient living without recurrence but blind	4 (50%)
Total number of patients living without recurrence	6 (75%)

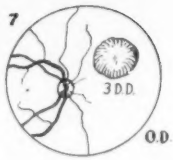
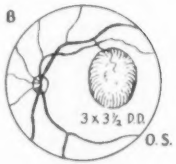
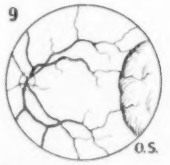
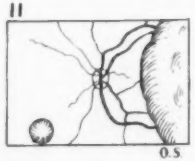
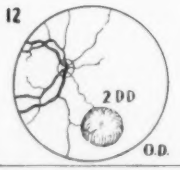
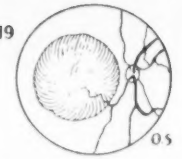
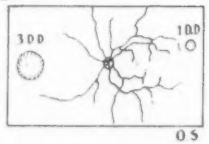
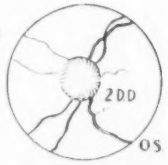
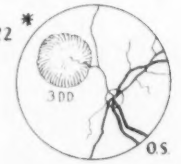
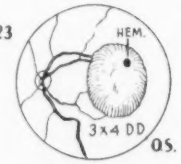
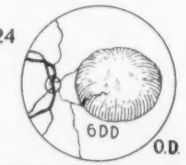
* This patient died of rhabdomyosarcoma arising in temporal muscle 8 years after treatment for retinoblastoma. Patient had good vision in treated eye for over 7 years.

sary before reliable conclusions can be drawn. Our end results in 9 cases of bilateral retinoblastoma in which treatment was given five or more years ago are incorporated in table 1. It will be noted that we have subtracted 1 of these 9 cases in our calculations because the results were indeterminate. In this case, the tumor in the eye regressed completely, and the child had good vision for seven years after treatment but died in the eighth year of rhabdomyosarcoma of the temporal muscle invading the orbit, there being suggestive, but not conclusive,

TABLE 2.—*Data on Twenty-Four Cases of Bilateral Retinoblastoma Treated Surgically and by Irradiation*

Case No. and Lesion (Location and Size Before Treatment)	Date of Admission	No. of Treatments	Total Treatment Period, Mo.	Total Dose in Roentgens: Temporal Portal	Nasal Portal	Eye Direct Portal	End Result
1	Feb. 16, 1933	46	16	10,000	2,400	.....	Growth arrested 11 yr. 4 mo.; vision 20/40; slight stationary cataract, not in pupillary area
2	Sept. 29, 1933	73	21	13,000	9,600	1,800	Growth arrested 8 yr.; radiation cataract removed; vision 20/200 (macular changes); patient died of rhabdomyosarcoma
3 	Jan. 7, 1935	61	15	10,800	10,450	1,750	Growth arrested 9 yr. 6 mo.; vision none; eye phthisical
4 	March 26, 1935	78	10	11,700	7,500	4,200	Growth arrested 9 yr. 3 mo.; vision none; eye phthisical
5 	May 20, 1935	78	13	11,200	10,800	3,900	Growth uncontrolled; patient died
6 	Sept. 5, 1935	107	14	14,550	14,550	3,250	Growth arrested (O.D.) 2 yr.; patient died of recurrence in left orbit

Case No. and Lesion (Location and Size Before Treatment)	Date of Admission	No. of Treatments	Total Treatment Period, Mo.	Total Dose in Roentgens: Temporal Portal	Nasal Portal	Eye Direct Portal	End Result
13 	Jan. 9, 1942	33	3	6,800	6,400	.....	Growth arrested (O.D.) 1 yr. 6 mo.; patient died of recurrence in left orbit and metastasis
14 	Jan. 26, 1942	40	5	7,850	7,850	.....	Growth arrested 2 yr. 6 mo.; vision seems normal to parents
15 	April 8, 1942	38	4	7,600	7,600	.....	Growth arrested 2 yr. 2 mo.; vision seems normal to parents
16 	May 16, 1942	38	4	7,600	7,600	.....	Growth uncontrolled; enucleation (O.U.); patient living and well after 2 yr.
17 	Aug. 10, 1942	40	4	8,000	8,000	.....	Growth arrested 1 yr. 10 mo.; vision seems normal to parents
18	Nov. 25, 1942	40	5	8,000	8,000	.....	Growth arrested 1 yr. 6 mo.; vision none

7 	Oct. 20, 1937	50	5	8,950	8,950	.....	Growth arrested 6 yr. 9 mo.; vision none; eye phthisical
8 	Sept. 6, 1938	35	3	7,200	6,800	.....	Growth arrested 5 yr. 9 mo.; vision 20/70
9 	June 29, 1939	70	22	9,150	8,940	5,200	Growth arrested 5 yr.; vision none; eye phthisical
10	May 14, 1940	54	5	10,800	10,800	.....	Growth uncontrolled; enucleation (O.U.); patient living and well after 4 yr.
11 	April 22, 1941	38	4	7,600	7,600	.....	Growth arrested 3 yr. 3 mo.; vision 20/70
12 	Oct. 16, 1941	36	3	7,450	7,450	.....	Growth arrested 2 yr. 9 mo.; vision seems normal to parents
19 	Nov. 27, 1942	38	4	7,600	7,600	.....	Growth arrested 1 yr. 6 mo.; vision seems normal to parents
20 	April 1, 1943	40	4	8,000	8,000	.....	Patient lost track of (address unknown); growth probably uncontrolled
21 	May 12, 1943	40	4	8,000	8,000	.....	Growth arrested (O.S.) 1 yr.; recurrence in orbit (O.D.); patient living and well
22 * 	May 7, 1943	40	4	8,000	8,000	.....	Growth arrested 1 yr.; vision seems normal to parents
23 	June 22, 1943	40	4	8,000	8,000	.....	Growth arrested 1 yr.; vision seems normal to parents
24 	April 24, 1944	Incomplete		Incomplete			Deferred

* Case 22 is that of a girl aged 2 years and 3 months with bilateral retinoblastoma. The father, now 31 years old, had bilateral retinoblastoma at the age of 18 months, in 1915. Both eyes were enucleated by Dr. Arnold Knapp, and the case was reported (Arch. Ophth. **49**: 575, 1920). The father, totally blind, is a successful lawyer.

evidence that the neoplasm arose as a late result of the irradiation. After necropsy, the microscopic examination of the irradiated eye showed that the retinoblastoma was completely arrested. We felt that the best disposal of this case was to count it neither for nor against the five year cure rate, although we might logically claim a cure.

During the last five years we have employed this method in 14 additional cases of bilateral retinoblastoma. In 3 of these cases the end results are determinate; that is, they are failures since the patients either died of the disease [2] or have a hopeless recurrence.[1] There are also 3 partial failures; although the growth appears to be under control, the patients are blind. Of the last series, of 14 cases, there is freedom from disease with vision in 8 (57 per cent). We present the data on the cases in which treatment was carried out during the last five years as a matter of record rather than of great statistical significance (table 2, cases 11 to 24 inclusive).

Retinoblastoma is a fairly radiosensitive tumor; it can be completely devitalized by a dose of radiation well tolerated by skin, subcutaneous fat, bone, nerve tissue, etc. There would, therefore, be little difficulty in sterilizing such a tumor except for the fact that it is not readily accessible to radiation and lies close to the radiosensitive ciliary body, lens and cornea. A dose of radiation lethal to retinoblastoma invariably destroys vision if it passes through the anterior chamber of the eye. As a matter of fact, the anterior chamber of the eye is so sensitive that it is irreparably injured by even a part of the dose necessary to destroy the tumor. The object of our method of treatment is, therefore, to direct and limit the size of the radiation beam so as to destroy the tumor with conservation of vision.

EARLY RECOGNITION OF RETINOBLASTOMA IN THE SECOND EYE

Retinoblastoma is presumably always a congenital tumor. Regardless of the age at which the tumor is first seen, it was actually present at birth, manifesting itself later because of an increase in size. It is usually stated that retinoblastoma is bilateral in about 25 per cent of cases (unilateral in 75 per cent), but our experience indicates that this figure is much too low and that certainly the growth is bilateral in the majority of instances. In cases of bilateral retinoblastoma, therefore, the tumor in the fellow eye should be demonstrable by careful examination at the time the lesion is recognized in the first eye. The tumor in the first eye is almost never recognized except in an advanced stage, when the growth has sufficiently filled the vitreous cavity to give a white reflex through the pupillary area and at a time when the tumor in the fellow eye is usually small and in a radiation-curable stage.

The small tumor in the second eye is frequently overlooked at the time the diagnosis is made in the first eye. Of the 24 cases of bilateral retinoblastoma reported by us, the diagnosis of the bilateral character was made in the beginning in only 14. The period of delay before discovery of the tumor in the second eye in the other 10 cases was as follows: twenty-six, twenty-two, nine, eight, six (2 cases), four, three and one (2 cases) month, respectively.

It has been amply demonstrated that the involvement of the two eyes is not due to extension from one to the other but is the result of the multiple origin of the growths. Detection of the lesion in the fellow eye is obviously of the utmost importance since the chances of success in treatment by irradiation are inversely proportionate to the size of the growth.

When the growth in the fellow eye is small and near the equator, or when it is peripheral, it may be easily overlooked. This possibility has impressed us strongly at times during the period of treatment, when we were making monthly examinations of the fundus with the patient under general anesthesia. A lesion observed and charted several times on a diagram as to location and size may not be readily located subsequently even though the examination is made under ideal conditions (general anesthesia, dilation of the pupil and use of a speculum for retraction of the lids and of forceps for rotation of the eye). We feel certain that in every case in which the diagnosis of retinoblastoma has been made in the one eye, the fellow eye should be examined thoroughly under the ideal conditions just stated. The assumption should be that the fellow eye is affected until it is conclusively proved otherwise. Occasionally, retinoblastoma is equally advanced in the two eyes, and then, of course, bilateral enucleation is the only treatment available.

Parents should be taught to know that a white reflex in the pupillary area of a child's eye may be a serious omen and that immediate advice is imperative. In several of our cases such a reflex was ignored for a rather long time. Another sign, occasionally noted first, is a squint, and, for this reason, parents should know that the deviation of an eye of a baby or child may be of more than cosmetic importance. Inequality in the size of the two pupils should also call for prompt advice. There are rare instances in which the parents receive proper advice regarding

the lesion but defer action for an indefinite period, hoping to find some doctor who holds out hope from less radical treatment.

SUPPLEMENTARY OBSERVATIONS ON CLINICAL COURSE OF RETINOBLASTOMA FOLLOWING RADIATION THERAPY

In our two preceding reports we described in considerable detail the intraocular changes and the complications following fractionated roentgen radiation therapy in cases of retinoblastoma. This discussion will not be entirely repeated here; but, as a result of systematic reexaminations during and following treatment in the additional cases, we have accumulated much supplementary information on the effects of radiation on retinoblastoma and on the eye in general.

Significance of Size and Form of the Tumor in Prognosis.—The smaller the growth, the more favorable is the case for treatment. Generally speaking, the prognosis is not favorable for any lesion occupying more than one quadrant of the fundus. A flat, less elevated retinoblastoma offers a better prognosis than a raised, nodular variety extending forward into the vitreous. Usually, the thickness, or elevation, of the tumor is a greater handicap in treatment than the area covered by the base.

If the tumor reaches the choroid, it grows there with abandon in the rich vascular supply and, in our experience, is uncontrollable by radiation. As soon as this complication is recognized, the eye should be enucleated.

Signs of Regression of the Tumor.—Probably the best index of regression is an increase in the calcium content of the tumor, as manifested by chalky white areas, gradually increasing in size and finally coalescing to produce a single, nodular mass of calcium having the appearance of cottage cheese. The increase in the calcium content goes hand in hand with generalized shrinkage of the growth. Around the periphery of the shrunken lesion there may develop a zone of chorioretinitic change in the form of atrophy and proliferation of pigment. In other cases portions of the tumor may disappear, and some small growths may vanish completely, leaving little trace.

Complications.—The several complications which occur in the treatment of retinoblastoma were fully described in our previous reports.

Glaucoma occurs mainly either because of overirradiation of the posterior portion of the eye, beyond the safe limit, or because even a small portion of the otherwise safe dose has passed through the anterior chamber of the eye. These factors are discussed in detail under subsequent headings.

Among our cases in which irradiation was successful we have had only 2 instances of cataract. In 1 case it was necessary to remove the lens, and in the other the changes were slight, nonprogressive and outside the pupillary area, with little interference with vision. These cataracts occurred in the first 2 patients whom we treated before we devised our present special apparatus and before we fully appreciated the need for accuracy in directing the beam of roentgen rays.

In our cases in which the treatment was not successful, with the growth uncontrolled despite irradiation beyond the safe limit, and in which the eye proceeded to atrophy and phthisis, there was, of course, no opportunity to rule out the development of cataract. As a matter of fact, with such advanced pathologic changes, cataract occurs irrespective of irradiation.

Late Vascular Changes.—In some of our earlier cases we observed peculiar changes in the fundus six to eighteen months after treatment was started, and at that time we believed that the tumors had not been controlled by radiation and that the growths were progressing. These changes consisted of hemorrhages over and around the site of the lesion, or at distal sites, particularly around the optic disk, with opacity of the adjacent part of the retina. At first we interpreted these findings, especially the hemorrhages, as signs of regrowth of the tumor. These interpretations led us to give additional radiation after an interval of several months of apparent control. In almost all instances in which additional radiation was given for these reasons, the function of the eye was lost as a result of new complications, namely, iridocyclitis, keratitis, intractable glaucoma and, ultimately, atrophy of the globe. As we became more experienced with the upper limit of tolerance of the eye to irradiation, we made it a rule not to go beyond the "safe point" no matter what the indication for further treatment, either at the end of the first course of treatment or subsequently. Since our last report we have been agreeably surprised to find that by rigid limitation of the dose of radiation, as hereinafter described, in many of the cases with late hemorrhages and opacities the condition has followed an entirely benign course, with neither recurrence nor further disturbance in function. We now recognize such changes as being vascular in character, consistent with alterations occurring in other heavily irradiated tissues.

Undoubtedly several factors enter into the explanation of these late vascular changes. The irradiation obviously causes atresia of the vessels,

and secondary vascularity appears from the surrounding, less affected vessels. These newly formed vessels, which grow into the site of the irradiated lesion, are thin walled and tortuous, resembling the vessels in irradiated skin and there called telangiectases. A possible factor in their formation is the atresia of a portion of the normal, smaller veins and capillaries as a result of the irradiation, with consequent dilatation of the vessels which remain so as to provide for a collateral circulation. Telangiectatic blood vessels are always more fragile than normal vessels; and in the retina such vessels are probably easily ruptured when the local blood pressure rises with increased pressure in the jugular venous area, where the veins have no valves. The jugular venous pressure, as well as the pressure in the intracranial and intraorbital regions, together with the pressure in the thorax, is raised with coughing, sneezing and vomiting.

Acute occlusion of arteries and veins may also be a late occurrence, the thrombosed veins giving rise to immediate hemorrhage and transudate over the region drained. The cloudiness and opacity of the lesion and of the adjacent retina are undoubtedly due to ischemia, edema or transudate, the factor involved depending on the type of vascular lesion.

We have noted that in any irradiated eye there may develop in the macular region around the fovea residual edema or multiple white deposits similar to the lesions commonly seen in nephritis, diabetes and the late stages of essential hypertension and known as the "star of the macula." Such macular lesions in irradiated eyes are secondary to late vascular changes. Two instances of this lesion have been noted in our series. In 1 case, in which the tumor was observed clinically and later examined microscopically, the macular deposits had an appearance and a staining reaction similar to macular lesions seen in the other diseases just mentioned.

TECHNIC OF FRACTIONATED RADIATION THERAPY OF RETINOBLASTOMA

In our second report [2] we described the apparatus, the irradiation factors and the technic of application of the radiation. These data are briefly summarized later in the present report, and the method is illustrated in figures 1, 2, 3 and 4. For a more detailed description of the technic the reader is referred to our previous publications. While we concede that results comparable to ours may possibly be obtained by a somewhat different set of treatment factors, nevertheless we question the wisdom of the introduction of any modification before a thorough trial has been given the technic which we have found to be successful in a fair percentage of cases. When a physician first attempts to employ a new (to him) method of treatment, there is always a hazard to the patient in disregarding, or changing, tested and recommended treatment factors. Some of these factors are, of course, arbitrary and optional, but others are of paramount importance. For the beginner, it is sometimes impossible to tell which are significant.

Since our first report was published, eight years ago, we have been disappointed to find in the literature the record of only a single case of retinoblastoma treated with fractionated radiation, the results in which are as yet indeterminate (after two and a half years). This case was reported by Tice and Curran,[3] who used a "modification" of our technic. Just what the modification was is not stated. We know of several other instances in which attempts were made to use our method, in all of which, so far as we know, the results were failures, we suspect because of injudicious modifications in the factors of treatment. Even at the risk of seeming dogmatic, we recommend that before any change is made the technic we have described be followed as closely as conditions permit until the therapeutist has become thoroughly familiar with it and with its results.

Some of the treatment factors outlined in our second report were somewhat modified from

Fig. 1.—Special cylinders for radiation treatment of retinoblastoma. *A* has an oblique distal end to fit against the temple. *B* is applied to the bridge of the nose to irradiate a growth in the retina on the contralateral side. It has a hooked projection to mark the margin of the beam of radiation, so that the cornea and the anterior chamber of the eye may be spared.

3. Tice, G. M., and Curran, E. J.: Treatment of Retinoblastoma: Radiation Therapy Supplementing Surgical Treatment, Radiology **42**:20-33 (Jan.) 1944.

the factors we recommended in our first, for the reason that we discovered several causes of previous failures. We have not subsequently found any reason to modify our technic from that described in our second report, except to limit definitely the total dose and not to give supplementary radiation for apparent recurrences. Some of the general aspects of the treatment require special emphasis, and these will be discussed under separate headings.

Fig. 2.—Roentgen irradiation of retinoblastoma. (*A*) The child's head is being held in position for irradiation of the posterior half of the left globe through a temporal portal. (*B*) The child's head is being held in position for irradiation of the posterior wall of the left globe through an oblique portal from the opposite side of the bridge of the nose.

Immobilization of the Child During Treatment.—The holding of a crying, struggling baby under an x-ray machine (fig. 3) for about ten minutes three times a week over a period of several months is an onerous undertaking. Such a task should, obviously, be the duty of the parents, or of other members of the family, who, though invariably willing, sometimes find it difficult, unfortunately, to understand what is required and how to follow directions. It is the responsibility of the therapeutist, nevertheless, to see that the parents comprehend what they are to do and that they realize the importance of maintaing the head in an exact position, so that the beam will pass precisely through the posterior half of the globe and not through the anterior chamber (fig. 2). A great deal of patience is often required to teach the less intelligent and less dexterous parents, and until they acquire facility and confidence it may be prudent to give two or three mock treatments. Despite such difficulties, we advise that the therapeutist make no compromise, such as increasing the diameter of the portal to lessen the requirements for accurate direction of the beam. We feel that it is neither humane nor safe to immobilize the child by purely mechanical means.

Fig. 3.—The child's body is immobilized by being wrapped in a sheet. One of the parents steadies the child's body, and the other holds the head in position during the treatment.

Apparatus.—Originally we used no special apparatus, except a metal cylinder of 2.5 cm. in diameter, with which we had some success.

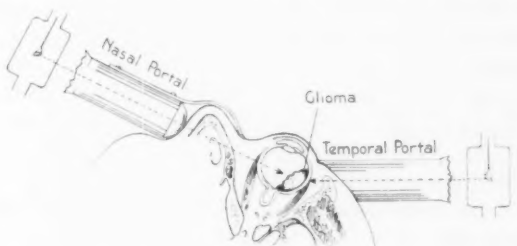


Fig. 4.—Local anatomy of the tumor. Cross section diagram showing the path and the objective of the roentgen radiation as directed through each of two portals.

In other cases, however, serious complications, sufficient to determine the difference between success and failure, resulted from the use of this rather crude apparatus. Since we devised the special cylinders illustrated in figure 1, the task of holding the child has become simpler, and inaccuracy in directing the beam and most of the danger of damaging irradiation of the sensitive anterior chamber have been avoided. We feel, therefore, that such special apparatus greatly increases the chance of success and should be used rather than any makeshift device.

Shape, Size and Position of the Skin Portal.—The size of the skin portal is undoubtedly one of the most important factors. The limit of accuracy in the direction of the beam of roentgen rays in these cases can hardly go further than to make certain that the radiation passes directly through the posterior half of the globe, in which the tumor always lies. Since the dose of radia-

tion lethal to retinoblastoma approaches the tolerance of the normal structures of the posterior half of the eye and exceeds the tolerance of the structures of the anterior chamber (lens, ciliary body, etc.), the size of the portal should be reduced to its smallest practical diameter and the beam so directed that no radiation strikes the anterior chamber. In our opinion, the practical size of such a portal is about 2.5 cm. in diameter, and probably there is no better shape than circular. A portal 3 cm. in diameter is, we believe, unnecessarily large and if centered over the retinal tumor will either include the anterior chamber or permit unnecessary irradiation of the orbital tissue posterior to the globe. Some of the unsuccessful results of which we have knowledge were, we believe, due to injudicious modifications of our technic; for example, the use of a larger portal, 3.5 to 4 cm., supposedly to relieve the therapeutist of the necessity of accurate centering. All of these attempts, so far as we know, resulted in failure.

As we described in our preceding article,[2] only two portals should be used, namely, a temporal and a nasal oblique (fig. 4). For a time we also used a portal centered directly over the pupil of the eye and directed backward. Even though we limited the dose through this portal to from 2,000 to 3,000 r, serious complications in the eye invariably developed, resulting in blindness eventually.

The treatment factors now used by us for retinoblastoma are as follows:

Voltage .....250 k. v.
Target-skin distance .....60 cm.
Filter .....1.5 mm. copper (equivalent)
Portal size (circular).....2.5 cm. in diameter
Position of portals (figs. 2-4)
(1) Temporal—directed transversely
(2) Nasal—directed obliquely
Frequency of treatments.....3 times a week
Single dose .....400 r
Maximum total dose.....8,000 r × 2

In our earlier cases we used roentgen radiation at 200 kilovolts and 0.5 mm. copper filter, with which the maximum and optimum dose proved to be about 7,000 r to each of the two portals. We have found, however, that with the factors now being used (250 kilovolts, 1.5 mm. copper filter, etc.) the maximum and optimum limit of useful dosage is about 8,000 r to each of these two portals.[4] With the latter set of factors, we have not obtained successful results with doses of less than 7,400 r × 2 or of over 8,000 r × 2. As already stated, we have also learned by bitter experience that should the tumor not regress after a dose of about 8,000 r × 2 (250 kilovolts, etc.) or should it show evidence of regrowth after several months, further irradiation not only is useless but invariably will bring on glaucoma, ending in blindness. We suspect that had we avoided supplemental irradiation (after the initial dosage of about 7,000 r × 2 at 200 kilovolts) in some of our first 9 cases, in which treatment was given prior to July 1939, our cure rate with vision would have exceeded the reported 25 per cent. If after a total dose of 8,000 r × 2 has been given with the aforementioned factors there is definite clinical evidence of residual growth, the eye should be enucleated. We have already described certain findings in the irradiated eye simulating regrowth of the tumor which in most cases we believe are benign in character and not a cause for alarm.

Justifiable Variations in Treatment Factors.—In 1933 we began the treatment of retinoblastoma by fractionated roentgen radiation at 200 kilovolts with a filter of 0.5 mm. copper, principally because high voltage apparatus of that particular form was then the standard at Memorial Hospital. A target-skin distance of 60 cm. was selected arbitrarily, chiefly for the reason that it was easier to immobilize and hold the child at this, rather than at a lesser, distance from the tube. At present we are using roentgen radiation at 250 kilovolts with a 1.5 mm. copper filter because this is now the standard form high voltage x-ray apparatus at the Memorial Hospital. We are of the opinion, however, that results comparable to ours can be obtained with any of the commonly used higher roentgen voltages (180 to 400 kilovolts) and with any filter of 0.5 mm. copper (equivalent) or upward. The target-skin distance should be at least 50 cm., but with the use of our special cylinders it will be more convenient to use 60 cm.

The frequency, or spacing, of the individual treatments (three times a week) and the size of the individual dose (400 r) have been selected by us to permit giving an uninterrupted series of treatments at the maximum rate of dosage increment short of causing unduly severe cutaneous reactions. With a more rapid rate of dosage increment the cutaneous reactions become troublesome. It is possible that, with these same factors, treatments of 600 r could be given twice a week with results comparable to those secured from 400 r three times a week, the main

4. We have found that, all other factors being equal, the dose as expressed in roentgens should be increased by about 10 per cent if translated from that given at 200 kilovolts with a 0.5 mm. copper filter to that required for the same clinical effect at 250 kilovolts with a 1.5 mm. copper filter. This rule will of course also apply in reverse.

disadvantage of the former being that both parents and child might object to the longer individual periods of treatment.

The most important factors regarding treatment, that is, those factors which will permit of the least variation from our recommended technic, are, we believe, the size of the treatment portal of 2.5 cm., the use of the special apparatus previously described and the accurate direction of the beam so that irradiation of the anterior chamber is avoided.

Reexamination of Child Under General Anesthesia.—If one could be certain that there is now no more to be learned from the systematic reexamination of patients with retinoblastoma while receiving this form of treatment, one might conclude from the foregoing discussion that, since we recommend a somewhat standardized technic and total dosage, frequent reexaminations would be unnecessary. On the other hand, it is only by such reexaminations, under the most favorable conditions, that one can determine the progress and the untoward complications in individual cases and learn to treat, or to avoid, complications incident to radiation therapy of retinoblastoma.

Since the beginning of this work, in 1933, it has been our practice to reexamine the patients at monthly intervals and under general anesthesia while they were undergoing treatment and for the first six or eight months afterward. After about a year the patients are examined at longer intervals (two or three months), and as the children grow older the examinations in some cases, but not in all, can be made without anesthesia. Some of our patients have had systematic examinations in this manner for a period of several years, receiving a total of twenty-five to thirty anesthesias. Such a program consists of more then a mere statement of the facts.

If such a routine should be interpreted as requiring the formal admission of the child to the hospital once a month and the administration of ether by the usual methods, it is probable that the program would be found too arduous and troublesome to carry out as a monthly procedure for any great length of time. We have found evidence of this difficulty in the cases of follow-up observation by ophthalmologists after the removal of one eye supposedly for unilateral retinoblastoma. The ophthalmologist, finding it too trying to arrange for ether anesthesia, has contented himself with infrequent examinations of the remaining eye without anesthesias. In several such instances the tumor in the second eye became far advanced and in the end was discovered by the parents, who finally observed the tumor through the pupil.

We believe that we have found a reasonably satisfactory solution of the difficulty. Up to this time, we ourselves have carried out all the ophthalmoscopic examinations on our patients. One of us (H. M.) administers the anesthetic and the other (A. B. R.) makes the ophthalmoscopic examination. With the facilities available to us, these examinations can be most expeditiously carried out for both clinic and private patients in one of our private offices. We have anesthetized and examined as many as ten children in the space of one hour and had them all out and on their way home within an hour and a half of the start of our project. The children are brought to the office early in the morning by special appointment, the parents having received instructions to omit breakfast and to instill homatropine at least one hour before arriving at the office. Chloroform is used as the anesthetic.[5] The induction takes only one or two minutes. The ophthalmoscopic examination then begins immediately and continues as long as the child lies still, usually two or three minutes. If a longer time is required, the mask is replaced for a minute or two, until

5. Our procedure for giving a short chloroform anesthesia is as follows: The body of the child is immobilized by being wrapped in a sheet. The administration of anesthesia is not begun until the ophthalmoscopist stands at the side of the examining table with his instruments ready to begin his examination, without any loss of time. A standard anesthetic mask, with six or eight thicknesses of gauze, is saturated with 3 to 5 cc. of chloroform, and the chloroform bottle is recorked and set aside. Chloroform is never dripped onto the mask, either during the induction or to maintain anesthesia. The mask is placed over the child's nose and mouth without any towel to impede free access of air. At the beginning the child will, of course, struggle and cry; then as anesthesia begins, the breathing becomes irregular and noisy, and within one or two minutes the breathing becomes regular and rhythmic. As soon as the regular and rhythmic respiration is noted, anesthesia is deep enough to permit the manipulations necessary for ophthalmoscopic examination. Without any loss of time the mask is then removed, the lights are turned out and the ophthalmoscopic examination proceeds as long as the child lies quietly, which is usually about two or three minutes. In the darkness, the anesthetist must depend on his sense of hearing to make certain that respiration continues. Attention should be given to holding the jaw forward, so that there will be no obstruction to respiration. The examination continues until the child begins to struggle; then if more time is required, the mask is rewet with chloroform (the bottle recorked and set aside) and again applied until the breathing becomes regular. There can be no question but that chloroform is a safe and uniquely valuable substance for induction of short anesthesia for a child if given in this manner. The precaution of not dripping the chloroform from the bottle onto the mask precludes overdosage. The omission of a towel about the mask insures an adequate oxygen intake.

the child quiets down. Afterward the partly conscious child is carried into the rest room; he is completely awake in about ten minutes and leaves the office under his own power in about thirty minutes more. There is rarely any nausea. In 150 or more examinations over a period of the last eleven years no untoward complication has occurred with the anesthesia, or after it, which appeared to be alarming in the slightest degree, and no parent has objected to the repetition of the procedure; no examination has been deferred, or omitted, because of any difficulty concerned with the anesthesia. To one who has given short chloroform anesthesia for ophthalmoscopic examinations to children by this routine, the contrast to the tedious admission to a hospital, the ether anesthesia and the long, and sometimes distressing, recovery is obvious.

737 Park Avenue.

635 West One Hundred and Sixty-Fifth Street.

ABSTRACT OF DISCUSSION

Dr. A. F. M. deRoetth, Spokane, Wash.: The outcome of this disease without treatment is blindness, followed by a miserable death. An investigation by Netherland ophthalmologists placed the incidence of retinoblastoma as 1 case in 34,000 births, a ratio indicating that 12 to 20 cases of bilateral retinoblastoma occur each year in the United States.

In 50 per cent of the 24 cases in which the authors employed their method of treatment the tumor was arrested or a cure was effected, with resulting preservation of vision. This percentage can be improved if the condition is discovered at an early stage. The authors call attention to early signs which may indicate retinoblastoma. Their introduction of the use of a general anesthetic for the thorough examination of these small children is to be welcomed.

It was my good fortune to refer a patient to the authors three years ago. Although the tumor is located in the macula, vision is now 20/70. Calcification of the tumor is still progressing, and the area of choroidal atrophy around the necrobiotic mass is enlarging. The child has another small tumor in the periphery, which has a typical "cottage cheese" appearance, an excellent characterization of the mass of calcified foci.

Retinoblastoma is radioresistant, and a large dose of radiation is necessary to destroy the growth. As to other treatment for this condition, a few permanent cures have been effected with radium, radon seeds and perforating diathermy, as in the cases of Schonberg, Moore and Stallard. In Budapest, in 1938, my associates and I treated bilateral retinoblastoma with perforating diathermy in 2 cases. This method was first employed by Weve. In 1 case the tumor was progressive after four or five months, but in the other case the growth was arrested and the patient was apparently cured one year after the operation. Would it be advisable to treat a small tumor with perforating diathermy combined with fractional irradiation?

I should like to stress the responsibility of the physician for the offspring of these cured patients. He should impress the parents of the patient, and later the patient himself, with the possibility of the hereditary character of the tumor.

This procedure in the hands of the authors saves life and vision in half the cases of this deadly disease.

Dr. Richard C. Gamble, Chicago: The authors have correctly termed their paper a report of progress, which indeed it is. It is interesting to read their earlier papers, published in 1936 and 1942, and then to read this article. One finds some change in technic, but little change in their interpretation of the effects of irradiation on the tumor and on the normal ocular tissues, as shown by careful study of the fundus. One finds considerable confirmation of the value of the procedure. Dr. Reese's observations on the changes in the fundus are classic; they should be carefully studied by any physician who has under his observation a patient with such a condition, for they state clearly when enough radiation has been given.

I have treated a few patients with bilateral retinoblastoma, and I have always used radium instead of roentgen radiation. I do not yet have the special cylinders that the authors have devised to limit the rays to a small portal; so I have felt that it was better to use radon seeds than to expose the entire eye to roentgen radiation, with almost certain damage to the lens, cornea and conjunctiva if a sufficient dose is given.

With the use of radon seeds the frequent small doses cannot be given. However, the effect of radon seeds can be supplemented by use of radium applicators over the temporal portal as often as necessary. The employment of such applicators fastened to a bridge in front of the pupil has had bad results. In 1 case it seemed to cause a severe pannus, which nullified an otherwise excellent result. It is interseting to see that the authors gave some radiation through the pupil in their earlier cases but discontinued the use of this portal after having discouraging results, in the form of phthisical eyes, blindness and death. This point deserves emphasis because attention to the danger involved in the future will save many patients from needless suffering and blindness.

The results obtained by Dr. Martin and Dr. Reese are magnificent. To arrest the growth in 12 of 24 cases with preservation of vision and to save the eyeball without vision in 5 other cases is an achievement.

With regard to the cases in which the growth invades the choroid, the authors apparently feel

that the fractionated irradiation method is useless. It is too slow. I should like to ask their opinion with regard to the possible value of treating this type of tumor by means of a Weve diathermy trocar plunged directly into the main mass and by making several rings of micropunctures around this to seal off the choroid, much as is done to close the hole in a case of retinal detachment.

DR. ALGERNON B. REESE, New York: Dr. de Roetth's suggestion with regard to the supplementation of irradiation with diathermy sounds feasible to me, particularly in view of the favorable effects that diathermy had in the cases he cited. It adds an extra hazard, however, and I wonder whether the advantages outweigh the possible disadvantages. I prefer not to use diathermy for the time being, until it can definitely be proved whether or not irradiation alone is adequate.

I agree with Dr. Gamble that it would be much better to apply radon seeds than to use diffuse roentgen radiation. In cases in which the tumor has reached the choroid, it is my feeling that no treatment is of value, since the tumor grows so rapidly in the vascular bed of the choroid that any measure directed toward control of the growth leads to destruction of the eye. I believe that therefore in such cases enucleation is indicated.

OCULAR WAR NEUROSES

CAPTAIN HENRY L. BIRGE *
MEDICAL CORPS, ARMY OF THE UNITED STATES

The importance of psychologic tension in producing syndromes resembling organic disease first received widespread recognition during World War I. We were left with the now outmoded terms of "soldier's heart" and "shell shock." Since that time the importance of the psychologic aspect of medicine has increased until it borders on the strategic. The present war has already gone through phases known as the "war of nerves."

This paper has a twofold purpose: (1) the closer integration of psychiatric states presenting ocular symptoms with the specialty of ophthalmology and (2) the analysis of a series of cases of diseases of the eyes with special reference to psychiatry.

One of the difficulties of treating psychiatry and ophthalmology in one paper is that the terminology and the classification of psychiatric disease are not yet as uniform as are their counterparts in the older specialty of ophthalmology. To the variations in psychiatric terminology must be added the variations in the neuroses and psychoses at different stages of evacuation from combat areas and in various theaters and zones of war. Another confusing factor in the evaluation of psychiatric problems is that many patients, especially those with mild disorders, are never examined by a psychiatrist. The increasing importance of the psychiatric side of medicine places more responsibility for proper psychiatric diagnosis on specialists in other branches of the medical profession. It is as serious for a patient with an ocular complaint to have a physician who neglects the psychiatric side of his case as it is for him to have one who neglects the ophthalmologic or other medical aspects.

MATERIAL AND METHODS

The material for the present study was taken from records of a series of 2,500 refractions and ophthalmic examinations made by the same staff, under my direction, in the eye clinic at the Station Hospital, Stockton Field, Calif.

All patients were subject to the same approach; that is, they were examined because of their ocular complaints. A complete ophthalmic survey was performed, including recording of the patient's history; examination of the external eye, the status of the ocular muscles and the visual fields; study of the ocular fundus, and, in most cases, refraction under cycloplegia.

The diagnosis of ocular neurosis was made by exclusion, at the end of the examination. The theory adhered to was that most persons had a reason for their complaints, and only when no organic cause was found was a condition labeled neurosis.

In ophthalmology there are several variables to be considered before a diagnosis of neurosis can be made. One of them is the low limit of refractive error that may give rise to ocular pain. Unfortunately, many physicians think of hysterical blindness as the most important type of ocular neurosis. On occasion dramatic instances of this occur, such as that of the student pilot who went blind on his first solo flight and had to land his plane by following directions given over the radio by an officer in the control tower. But the majority of cases of ocular neuroses are of a less dramatic variety. They are so similar in history and complaint to cases of true pathologic conditions of the eye that they cannot be differentiated without an ophthalmic examination. The experience of my colleagues and myself has shown that many ophthalmologists do not properly evaluate the type and degree of the neurotic symptoms in conjunction with the ocular findings. Conversely, other diagnosticians may attribute all the ocular pains to neurosis when ophthalmic examination will reveal an organic cause for the pain in the eyes.

Records of patients with ocular complaints were surveyed from the psychiatric point of view. It was found that there were three groups of persons with ocular symptoms: (1) persons with simple psychoneuroses; (2) persons with psychosomatic conditions, with the relative importance of the neurotic and the organic disturbance different in each case, and (3) persons with strictly organic disorders.

The incidence of neurotic patients in the group studied was low as compared with the proportion of neurotic patients (80 per cent, if the general impression is correct) encountered in unspecialized civilian practice.

Most of the patients studied were members of the ground personnel of the Army Air Forces, and little ocular neurosis was found in flying personnel except that coincident with serious visual disease. Malingering was a rarity.

A large majority of the patients studied had a refractive error, a muscular anomaly or some other condition requiring either medical or surgical treatment; these patients were considered free of neurosis. A small minority of the patients studied had a history of neurosis but were found to have an organic basis for many of these symptoms; these patients were considered to have psychomatic ocular disease. Except for a chart of the visual fields in case 1, figures, charts and diagrams have been omitted from this study because of previously mentioned variables beyond immediate control.

* Formerly assistant ophthalmologist, Hartford Hospital, Hartford, Conn.; ophthalmologist to Newington Home for Crippled Children, Newington, Conn., Connecticut Institute for the Blind, Hartford, Conn., and American School for the Deaf, Hartford, Conn.; consulting ophthalmologist to Manchester Memorial Hospital, Manchester, Conn.

OCULAR WAR NEUROSES

In general the war neuroses form a clinical entity based on anxiety. They are similar to the traumatic neuroses seen in civilian practice. They may occur in either the acute or the chronic form, and frequently one patient will go through various stages of a neurosis. They present a wide variety of syndromes,[1] with most of which this paper is not primarily concerned.

Ocular neuroses form a small and unimportant group of war neuroses. They are of importance, however, to the ophthalmologist, who is called on to recognize them and to see that they get the proper treatment. In an attempt to give a true picture of ocular neuroses in their relation both to psychiatry and to ophthalmology and to set them in their proper light among other war neuroses, it is necessary to outline a loose classification of the various types of neurosis.

I. Psychoses
- A. Organic
  - 1. With infectious diseases
  - 2. With disturbances of circulation and exhaustion
  - 3. Senile and involutional
  - 4. With metabolic diseases
  - 5. With new growths
- B. Toxic
  - 1. Caused by alcohol
  - 2. Caused by gases, metals, drugs, etc.
- C. Traumatic
  - 1. Traumatic delirium
  - 2. Post-traumatic personality disorders
  - 3. Post-traumatic mental deterioration
- D. Functional
  - 1. Manic-depressive psychosis
  - 2. Dementia precox
  - 3. Paranoia
  - 4. With psychopathic personality
  - 5. With mental deficiency
  - 6. Undiagnosed forms

II. Psychoneuroses
- A. Anxiety states
  - 1. Acute psychoses
    - (*a*) Severe
    - (*b*) Mild
  - 2. Chronic psychoneuroses
    - (*a*) Early stress
    - (*b*) Established tension
    - (*c*) Exhaustion
- B. Hysteria, conversion type
- C. Psychasthenia or compulsive states
- D. Neurasthenia and hypochondriasis
- E. Reactive depression

III. Psychosomatic states

IV. Malingering

Considering the variable diagnostic criteria of psychiatrists and the variable syndromes in each neurotic state as it is affected by the relative proximity of the patient to the battle front or to bombing attacks, it becomes more important than ever to emphasize the group to which a patient belongs rather than to use terms of more limited diagnostic coverage.

Causes of War Neuroses, Including Ocular Neuroses.—The war neuroses of all types, especially the anxiety states, are not so dependent on abnormal psychiatric backgrounds as are the civilian neuroses. War neuroses are predominantly due to present stress and strain. The present study is not concerned with the acute, severe forms of war neurosis that bring soldiers back from the battlefields in psychotic states, the result of constant noise and turmoil, the killing and the danger of war. The anxiety from these causes, the mental conflict between duty and the instinct of self preservation, the fatigue and privation are obvious causes of their condition.

Ocular anxiety neuroses are of mild type, in contrast to severe anxiety states, which result from battle experience, resemble a true psychosis and are often diagnosed as schizophrenia. The ocular neurosis, like the gastric or the cardiac neurosis, is seen behind the lines. It is of the chronic type and is similar in many respects to that seen in civilian practice. The conflict is often, for instance, one of frustration, due in part to lack of promotion after long service and in part to other long-sustained states of dissatisfaction associated with Army life. Frequently there are several conflicts, each of which contributes its share to the vicious circle of dissatisfaction, insomnia and fatigue. It is rarely a single disappointment that brings on the anxiety state. Usually it is the cumulative effect of the relentless conflict, whatever it (or they) may be, with no hope of relief, that sets the neurosis in motion. The mental conflict leads to anxiety, and anxiety leads to excitement of the emergency mechanism and to overaction of the autonomic nervous system. An anxiety state comes into being in the stage of early stress.[2] It may either progress to the stage of established tension or subside. The anxiety state becomes pathologic when it persists in the absence of stimuli sufficient to cause normal anxiety.

Physical factors, like hunger, thirst and exposure, also have considerable bearing on the acute neuroses of the front lines. In the zones of the interior these factors are usually absent, as are shelling and blast injuries. Fatigue is a factor frequently associated with development of the neurotic states. Not always is the fatigue that of

1. Grinker, R. R., and Spiegel, J. P.: War Neuroses in North Africa, New York, Josiah Macy, Jr. Foundation, 1943. Miller, E.: The Neuroses in War, New York, The Macmillan Company, 1943.

2. Stephenson, G. V., and Cameron, K.: Anxiety States in the Navy, Brit. M. J. **2**:603-607 (Nov. 13) 1943.

physical exhaustion: It may be the type that comes from performing a dull task over a long period.

Some neurotic persons undoubtedly have an inherited tendency to anxiety. In others there is no evidence of either hereditary tendency or previous episodes of anxiety.

Sexual conflicts do not seem to have much bearing on the anxiety type of war neurosis. They may constitute one factor underlying chronic maladjustment, but other factors outweigh this aspect in most cases. It is not necessary to go into the relation of the hypothalamus, the cortex and the autonomic nervous system in this paper.

Some Common Types of War Neuroses.—The term constitutional inadequacy covers a loosely classified group that includes various neurotic states, as well as some psychosomatic conditions, but it implies some deficiency in the inheritance of the patient and usually exists apart from the anxiety states.

Hysteria is often confused with the anxiety state. Hysterical states develop from conflicts between the cortical centers which are the seat of the sense of duty and the lower centers of the brain, whose chief function is one of self preservation. These states occur most frequently in suggestible persons. An uncritical personality is often associated with hysterical manifestations.

The obsessive states are more complicated and may show up in cases of long-standing anxiety, especially in introspective personalities.

Syndrome of Ocular Anxiety Neurosis.—Anxiety states vary as to type and degree. One person may be seen in different stages of the anxiety state at different times. The anxiety syndrome of the advanced clearing station is the anxiety state in its most severe form. The anxiety states seen in men behind the lines are milder and are often not disabling, although they undoubtedly would progress to the severe type rapidly if the person affected were subjected to the mental trauma of battle. Morale and the presence or absence of treatment, as well as the man's tolerance for anxiety, make the breaking point of each person different.

No attempt is made here to separate the syndrome of the ocular anxiety neurosis into subgroups according to type or degree. It is helpful in understanding how the anxiety state develops to think of the stages of "early stress," "established tension" and "anxiety with exhaustion," but for the form involving the eyes this subclassification is unnecessary.

Ocular neurosis is not often associated with complaints referable to other organs, although when other organs are involved, whether organically or functionally, the neurosis is less likely to be cured and is apt to come to a focus in some site other than the eye.

The ocular neurosis is not usually a disabling state. It is often associated with insomnia. Headache is one of the most frequent symptoms, although the neurosis may simulate almost any type of ocular disease. It has, however, never simulated glaucoma in my experience.[3] This is an important point, because in some textbooks the syndrome of ocular neurosis is described as involving blurred vision and the seeing of halos around lights, symptoms which, together with ocular pain and headache, are suggestive of chronic simple glaucoma to the ophthalmologist. In the anxiety state headaches, ocular pains and easy visual fatigue are common. Often there is twitching of the lids, which may develop into true blepharospasm. When blepharospasm develops it becomes a form of hysteria. While anxiety in a mild form is susceptible to wilful control by relaxation, when the patients are seen the tics of the eyelids and the blepharospasm have gone beyond the point where they are controllable. Photophobia is a frequent finding, and many patients with ocular anxiety neurosis cannot be comfortable without colored glasses.

The headaches cause serious interference with efficiency. Often they are of daily occurrence, and they may persist for weeks, being poorly relieved, if at all, by 12 or more acetylsalicylic acid tablets a day. The headaches may be found in patients who report having had cranial trauma in childhood without sufficient damage to justify the disturbance being classified as a post-traumatic syndrome. The headaches frequently appear to be atypical migraine, although they usually do not respond to ergotamine tartrate. The headaches were described by 2 patients as different from migraine headache, which these patients also had. These headaches are sometimes associated with subjective disturbances in depth perception, although the tests for depth perception give normal results. The disturbances in perspective are difficult for the patient to describe. There is often a complaint of dizziness.

The visual disturbances associated with anxiety neuroses vary from transient attacks of blurred vision to transient spells of complete blindness, in which a patient will have to pull his car off the road for ten or more minutes. We have examined several such patients shortly after their attacks

3. Weiss, E., and English, O. S.: Psychosomatic Medicine, Philadelphia, W. B. Saunders Company, 1943, pp. 35 and 490.

and have always found the eyes and the visual acuity normal and the visual fields normal in all respects.

Under the tension of the physical examination for overseas service, we noted several patients with anxiety states who showed a loss of 40 to 50 per cent in visual acuity and whose vision returned to normal during the relative calm of a subsequent examination of the eyes. None of these patients required tests for malingering. The same apparatus was used for the two tests. During the lengthy ophthalmic examination, the numerous tests of muscular function and of the visual fields and the interval of waiting for the cycloplegic, the patients became relaxed, and their vision returned to normal. Only 1 of this group exhibited transient hypertension as a reaction to the sphygmomanometric determination, and he also showed generalized narrowing of his retinal arteries, grade II, without sclerosis or retinopathy.

Contrary to another contention of the textbooks, the visual fields in this series of patients with ocular neuroses were normal more often than not. The well known gun barrel type of field was found frequently in patients with severe ocular neuroses, especially in men of low intelligence. It is more apt, however, to be associated with hysterical or obsessive states than with simple chronic anxiety. Ring scotoma was often found and was probably associated with the easy fatigability of these patients. Interlacing of the color fields is also pathognomonic of a functional ocular disorder. This finding is comparatively rare, in our experience, and many diagnoses are made without it on the basis of other functional disturbances.

Patients with ocular neuroses of the anxiety type frequently complain of seeing spots or webs in front of their eyes. These spots move with movements of the eyes and are always more vividly seen on a light background. The functional variety of spots before the eyes is termed muscae volitantes and is usually associated with normal corrected visual acuity. In the absence of precipitates on the lens or the cornea, of opacities in the vitreous or of chorioretinitis, these spots are entirely harmless, and yet they cause endless trouble to the patient, as well as to the examining physicians, from the gastroenterologist and the neurologist back to the opthalmologist.

One of the discomforts of the ocular neurosis is the burning of the eyes that is associated with epiphora. Watering of the eyes is transient, is worse in cold weather and is not related to obstruction of the tear ducts or to abnormal secretion of tears, although the lacrimal glands may be affected by the overfunctioning of the autonomic nervous system in anxiety states.

The syndrome of the ocular anxiety state may be said to include the following complaints with sufficient regularity to make it apparent almost immediately on talking with the patient: ocular pain, headache, twitching eyelids, spots before the eyes and burning of the eyes, with epiphora, photophobia and occasional distortion of perspective. Other evidence of neurosis is often apparent, such as insomnia, perspiration of the palms, occasionally a speech defect and often a history of nervousness.

Case 1.—A private aged 20 suddenly went blind at roll call. He had already had one attack of blindness the week before. In each instance the blindness was of short duration. The patient stated that he had had severe headaches steadily for two weeks previous to this admission to the hospital.

Ophthalmic examination was made after physical examination and revealed nothing abnormal. Vision of 20/200 was improved to 20/15 with the following correction: right eye, —1.50 D. sph. ⌒ —1.25 D. cyl., axis 180; left eye, —1.50 D. sph. ⌒ —1.00 D. cyl.,

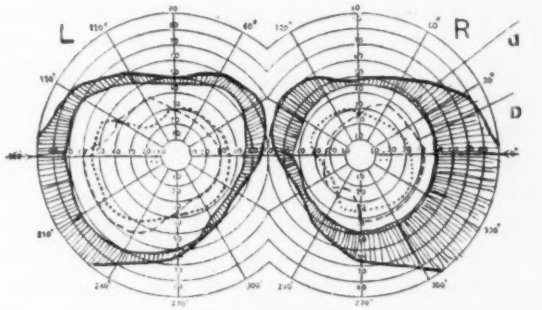


Chart of interlacing color fields. The field for 3/330 white (*a*) is essentially normal. The field for 5/330 red (*b*) interlaces in each eye with field for 5/330 blue (line of dots).

axis 180. Orthophoria was present. The visual fields showed moderate interlacing of color fields. The form field was normal. The blindspots were normal (right 5 by 6 mm. and left 6 by 6 mm.) with white. The external and the internal eye were normal.

The patient's glasses were not changed; he returned to duty and carried on successfully.

Case 2.—A private aged 24 complained of blurred vision accompanied with severe headaches, which he had had for several weeks. His eyes felt tired at the end of a day's work. He had twitching of the eyelids, which had been increasing during the past few days.

His history included overseas service in China and the Philippines, but he did not attribute his nervousness to war experience. He had noted nervousness since the age of 12 years, when he was unconscious for fifty-two hours after a severe fall. During his youth he had fainted several times from excitement. He had had several attacks of abdominal pain during the past year, and on one occasion he ws admitted to an Army hospital because of the possibility of appendicitis. The diagnosis at discharge was psychoneurosis. He had had enuresis until the age of 16 years.

Examination revealed a person whose voice quavered with emotion and who perspired freely at a comfortable

room temperature. Refraction under a cycloplegic gave the following results: In the right eye, with a + 0.25 D. sph. ⌒ + 0.50 D. cyl., axis 85, vision was 20/15; in the left eye, with a + 0.25 D. sph. ⌒ + 0.50 D. cyl., axis 90, it was 20/15. The external eye was normal. There was exophoria of 1 prism diopter and no hyperphoria. Convergence was 7 prism diopters. Divergence power was 3 prism diopters. The visual fields and the fundi were normal. No glasses were prescribed.

This patient received a short furlough and returned to duty. He was able to understand his nervous makeup and planned to take steps to prevent nervous exhaustion.

Case 3.—A private aged 24 complained that he had broken his glasses and could not get along without them. He stated that he got headaches and inflamed eyes from not wearing them.

Ophthalmic examination revealed that the eyes were entirely normal both externally and internally. The muscular balance was normal. There was 1 prism diopter of exophoria and no hyperphoria. Convergence was 22 prism diopters. Divergence was 12 prism diopters. The visual fields were entirely normal. Cycloplegic refraction revealed vision of 20/15 in each eye with the following correction: right, + 0.50 D. sph. ⌒ +0.50 D. cyl., axis 100; left, + 0.50 D. sph. ⌒ + 0.75 D. cyl., axis 75. The patient had been wearing (and had vision of 20/20 with) glasses with the following corrections: right eye, + 0.25 D. sph.; left eye, + 0.25 D. sph. This represented to us a false idea on the part of the patient, namely, that he needed glasses for constant wear. We found no other evidence of neurosis and tried to convince the patient that he would get along as well without glasses.

It might be argued that this patient needed his full cylindric correction. We have often prescribed cylinders of this strength. This case is cited to emphasize the importance of weighing the psychoneurotic symptoms against the ocular findings. We felt that since the patient had been happy with a simple sphere, there was no need to correct his cylinder, and that most of his trouble was psychologic.

These 3 cases illustrate the fact that ocular neurosis has no relation to refractive error. In some cases orthometropia is associated with weighty symptoms. On the other hand, large refractive errors are found in truly neurotic persons.

Case 4.—A guard aged 22 was referred to the eye clinic because of his ocular complaints and a question of compensation.

His chief complaint was that he saw a spot before one eye that looked like a cluster of small bubbles. He also had headaches and stated that his eyes frequently became red. He attributed all his symptoms to an injury sustained when a shingle blew off a roof and struck him in the right eye while he was patrolling. The accident happened in April 1942. He was treated for two days in the dispensary, and when the bandage over the eye was removed he saw the spot in front of his right eye. He was sent to the clinic because the spot had enlarged to such an extent that it could now blot out a jeep 50 feet (15 meters) away. Immediately after the injury he had been referred to a civilian eye, ear, nose and throat specialist, who treated the eye for a while and then discharged him as cured. Because of his continual complaints the patient was referred to an Army hospital, where he saw another eye, ear, nose and throat specialist. This physician saw a small opacity in the lens, which he mentioned to the patient. Examination of this spot in my clinic showed it to be congenital and no larger than a speck of dust.

At a later date the patient was referred to San Francisco, where an ophthalmologist who examined him stated that there was evidence of an old hemorrhage in the retina. We did not see the patient until fifteen months after the injury, but at that time there were no scars in the retina.

Examination revealed that the patient had blepharospasm. Vision was 20/100 uncorrected in the right eye and 20/30 in the left. Externally both eyes showed moderate redness, due to mild follicular conjunctivitis. Local use of eye drops was prescribed.

Considerable time was required for examination of the patient because of his apprehension, but finally a careful observation of the fundus was made. The only ocular abnormality was the previously mentioned congenital opacity of the lens, the size of a speck of dust. The cornea and the media were clear. There was no evidence of a retinal detachment. The choroid showed normal pigmentation in the periphery. The nerve head was distinct and without pallor.

Visual fields were taken with some difficulty because of the pain which the patient felt in his eye during the examination. The fields showed a generalized contraction in the right eye but were normal in the left eye. Refraction under a cycloplegic showed that vision of 20/20 could be obtained in the right eye with + 0.50 D. sph. and in the left eye with + 0.25 D. sph. ⌒ + 0.25 D. cyl., axis 99. Measurement of the phorias was normal.

The spot seen by the patient was visible only on a light background and was not visible ophthalmoscopically, nor did it show as a scotoma on examination of the visual fields. It was diagnosed as muscae volitantes.

Had this patient's complaints been recognized as psychoneurotic by the first four physicians who saw him, he never would have progressed to the acute state of ocular anxiety neurosis.

The psychic element in every case should be determined before treatment or other disposition is made. In cases of injury or suspected disease of a highly specialized organ such as the eye, specialized consultation is advisable. Only the physician who is absolutely sure of himself can diagnose the absence of organic disease. In cases of doubt a neurosis grows luxuriantly.

Differential Diagnosis.—It is not yet entirely clear just where the dividing line lies between the refractive errors that do and those that do not cause ocular pain and asthenopia. Undoubtedly many persons who have a smaller error than 1.25 D. need glasses. Especially in cylindric corrections does one see symptoms relieved by 0.50 and 0.75 D. In myopia a spherical correction of 0.50 D. makes a great difference and often relieves asthenopia which is unaccompanied with neurosis. The dividing line between neurotic and pathologic is not definite. It must be drawn in each case by estimating the weight of each factor.

The cases which are considered to involve neuroses in this series are those in which the patients did not have sufficient pathologic changes in the eyes to justify their complaints. That must be the basis of the diagnosis in every case. It leaves a variable factor—the physician—which will become more nearly a constant as more attention is paid to the neuroses. Another variable is the degree of nervous exhaustion in the patient, especially in the patient with an anxiety state. In wartime this is almost always greater than in peacetime. In patients with nervous exhaustion a small defect may give rise to disabling psychosomatic symptoms, or the exhaustion may be a factor in a simple neurosis.

Hysteria and the Obsessive State.—Hysterical and obsessive phenomena in patients with ocular neuroses seem to have more relation to the genetic background and to a previous neurosis, especially one of a long standing, than do anxiety neuroses with ocular manifestations. These conditions are too complicated for the ophthalmologist to classify psychiatrically.

Some of these manifestations are defense mechanisms. Most of them are not associated with anxiety, although they may be found in untreated or poorly treated anxiety states of long duration. In the majority of patients with these conditions there is bland complacency. Hysterical and obsessive states were rarely encountered in this series. The following cases illustrate the obsessive state, or conversion hysteria.

Case 5.—A private aged 21 reported for an ophthalmic examination because his head "felt light." He had noted this feeling all his life, but it became worse after he entered the Army. He had no ocular complaints, although he had insomnia. He was able to do all his work without difficulty. He sat quietly without looking at the examiner and showed evidence of being introverted and of the schizoid type. He was not interested in reading; when pressed, he admitted that he liked to bowl but said he had not done much of it in the Army.

Examination revealed his vision to be 20/80 in the right eye and 20/100 in the left. He was able to read 0.75 M with each eye. The refractive error was as follows: right eye, + 0.25 D. sph. ⌒ + 0.50 D. cyl., axis 105 (vision 20/80); left eye, + 0.50 D. sph. ⌒ + 0.50 D. cyl., axis 15 (vision 20/100).

The visual field was contracted to within 30 degrees in each eye, and a relative central scotoma was present in each eye. The blindspots could not be mapped out because of lack of cooperation. There were 4 prism diopters of esophoria, 18 prism diopters of convergence and 12 prism diopters of divergence. External examination gave normal results; ophthalmoscopic examination revealed only a remnant of a pupillary membrane in the right eye. Examination showed the fundus to be normal.

Vision of 20/80 and 20/100 is too poor to enable a person to do all the things this patient did without difficulty. He was not alarmed by the poor vision. It was not becoming worse. No ocular treatment was offered this patient. He was referred to the psychiatrist.

The following cases are further examples of obsessive states or conversion hysteria.

Case 6.—A technician (fifth class) aged 28 was referred to the eye department because he had been told that medical discharge for his poor vision was indicated. He was said to be able to carry out the duties assigned him, and therefore his officers were desirous of retaining him if regulations permitted.

He complained of aching in the head and eyes which occurred about four times a week and usually lasted two days at a time. He had noted spots before his eyes for years. His vision had begun to blur four years prior to this examination, but he had not been examined previously and, according to his history, had never worn glasses.

Examination revealed the eyes to be normal externally and internally. In the right eye vision was 20/400 (no Jaeger) with a + 4.50 D. sphere, and in the left eye, 20/300 (Jaeger 7) with a + 4.00 sphere.

His visual fields were normal except for relative central scotomas. He had 4 prism diopters of esophoria, 29 prism diopters of convergence and 5 prism diopters of divergence. Since he had never worn glasses, it was considered advisable to give him a full correction.

A case of this type belongs in the psychosomatic group, but the obsessive or hysterical character of the poor vision was so marked that it outweighed the large refractive error. One mistake in handling this patient was made by the person who told him before ophthalmic consultation was obtained that he was to be discharged from the Army. The patient probably had amblyopia ex anopsia of his right eye, but the poor vision in his left eye should have improved with glasses. After two months of trial of glasses, observation and reassurance and a reexamination of his eyes for evidence of progressive visual loss or increasing size of scotomas, he was referred for psychiatric treatment.

No change in his vision was obtainable with any lenses. Although he was more comfortable with them at times, no evidence of malingering was uncovered, although several examiners suspected a variable amount.

Case 7.—A healthy young soldier, a mechanic of 19 years, was hit on the head by the tip of an airplane wing. It was a mild blow, occurring as he lifted his head after bending over. He was not stunned, nor did he report to the physician, but two weeks later he suddenly suffered an attack of blindness, which lasted an hour. Similar attacks occurred with increasing frequency. He was hospitalized, transferred several times to other hospitals and finally discharged from service because of these attacks of blindness. They could be brought on by a gentle bump on his occiput. Jarring the cranium in any other way would not bring on an attack; but if anything or any one bumped his occiput even slightly, he would suffer an attack of blindness.

These spells came on whenever the patient was struck on the occiput during his stay in the hospital, but after his discharge he was able to work without difficulty in a subdepot at an air field. He retained the fear that if he received a blow he would go blind, but in nearly a year no complaint was made. This shows

that his spells of blindness had been motivated by a desire to get out of the Army. In other words, they served a purpose, and on that basis they were classed as hysteria.

Ophthalmic examinations, including examinations of the visual fields, always gave completely normal results, whether performed at the patient's original station or at other stations.

PSYCHOSOMATIC OCULAR DISORDERS

The dividing line between the neuroses and the psychosomatic states is not a straight and narrow one. The group of cases of the latter condition is composed of those in which there was evidence of (1) psychoneurosis (frequently an anxiety state) and (2) ophthalmic abnormality on examination.

Too many eyes have been lost as a result of chronic simple glaucoma to permit one to lose sight of the fact that a pathologic condition in the eye often does not give rise to symptoms. A diagnosis of psychosomatic state is not tenable without complete ophthalmic examination. The limits of ocular pathology and the classifications of ocular disease are well defined. Included among pathologic abnormalities are those of pathologic physiology, such as divergence excess and divergence weakness.

The complaints of the patients with psychosomatic disorders were similar to those of patients who had only an ocular neurosis, but the examinations revealed a pathologic condition. In some patients one eye had been removed because of injury or disease. The other eye gave occasion for ocular complaint and yet on examination was found to be within normal limits. A one-eyed person cannot be classed as normal: The remaining eye may be subjected to strain because it is an only eye, and the psychic trauma of the loss of an eye makes the patient unduly sensitive to symptoms in the remaining eye. In these patients all the etiologic factors for a psychoneurosis were present in addition to an actual pathologic condition—the loss of an eye. Other patients in this group had had operations for strabismus, usually with good results, but they had frequent headaches, and the weaker eye gave them occasional pain.

In this group are the patients with muscle imbalances, for example, a man with divergence weakness who has orthophoria for near vision and 7 prism diopters of esophoria for distance; vision was 20/15 in each eye, and refractive error + 0.50 D. cyl. in each eye. Such a person may well display physical symptoms, but there is frequently an overlay of neurotic symptoms. A case was included in this series in which divergence excess was associated with impending divergent strabismus and exophoria of 14 prism diopters. Refraction showed that for vision of 20/15 the following corrections were required: right eye, + 0.25 D. sph. ⊂ + 0.25 D. cyl., axis 10; left eye, + 0.50 D. sph. ⊂ + 0.25 D. cyl., axis 175. In this group are also found the large refractive errors, for instance: right eye, — 14.00 D. sph. and left eye, — 14.00 D. sph. — 1.00 D. cyl., axis 180, or right eye, — 1.75 D. sph. ⊃ + 4.00 D. cyl., axis 115 (vision 20/20) and left eye, — 3.00 D. sph. ⊃ + 6.50 D. cyl., axis 75 (vision 20/40). A person with this error in refraction would be unusual indeed if he did not have ocular complaints. Without a refraction he might be termed a "gold brick." After the refraction knowledge of his error requires that allowances be made for deficiencies in vision.

Patients with deficiencies in fusion are included in this group. A patient, aged 26, with alternate suppression and with no other abnormality evident on examination, stated that he could not get along without glasses whose strength was + 0.37 D. What oculist could say that this conviction had a purely neurotic basis? The weight of the neurotic symptoms must be evaluated; so must the evidences of pathologic change. Patients with true and permanent hyperphorias make up a good percentage of this group. They almost all have headaches and blurred vision. They get some relief from vertical prisms if they will wear them, but the ocular symptoms persist.

Patients with anisometropia and aniseikonia also belong in this group. They have real refractive errors but are constantly inefficient in their work because of ocular discomfort.

CASE 8.—A soldier aged 23 was operated on in the Army for divergent strabismus. A 10 degree overcorrection was evident. The patient stated that he had been told he did not require glasses because one eye was amblyopic. He came in requesting further surgical treatment. He was in a mild anxiety state, and because of this operation was not considered advisable. In order to put off operation, a complete ophthalmic examination was made.

The findings were significant, but the most important factor obtained from the examination was the patient's confidence and cooperation. It was found that his refractive error was: right eye, + 4.00 D. sph. ⊂ + 1.25 D. cyl., axis 80 (vision 20/800); left eye, + 1.50 D. sph. ⊂ + 0.50 D. cyl., axis 75 (vision 20/30). We convinced him that all he needed was glasses. His anxiety cleared up greatly, and after he had worn the full correction for two months, his eyes became grossly parallel.

CASE 9.—A private aged 21 complained of headaches and burning eyes. He stated that he was chiefly concerned because of attacks of blindness in his good eye, which occurred about four times a week. At these times he lost half the vision in his good eye, usually the upper half; he could see the lower halves of objects during these episodes. One of these attacks had recently occurred in the morning in the barracks; another, while he was driving his car.

He was studied especially from the point of view of vascular spasm. Even when he was given vasodilating drugs the attacks occurred. He did not seem to recover any sooner after inhaling amyl nitrite. The macular vessels in his good eye were always observed to be wide and normal.

The vessels in the amblyopic eye were slightly attenuated, although no evidence of vascular spasm was noted. Roentgenograms of his ocular foramens were normal, as were roentgenograms of his skull. Frequent examinations of his visual fields showed only slight enlargement of the blindspot shortly after these attacks. The altitudinal anopsia was never demonstrated by examination of the visual fields, although he reported to the clinic within ten minutes after having one of his spells.

Ophthalmoscopically the nerve heads were entirely normal. Refraction revealed the following error: right eye, + 0.50 D. sph. (vision 20/20); left eye, + 4.50 D. sph. ⌒ + 3.50 D. cyl., axis 100 (vision 20/400).

He stated that the loss of vision in his left eye was due to an accident in childhood in which he had injured that eye with a wire. No evidence of a perforation was seen in the cornea, the sclera or the retina. His poor vision was attributed to amblyopia ex anopsia, a conclusion which was borne out by a typical wide field with a normal blindspot but with a central scotoma.

When he was assured that his complaints had a nervous basis and that he was not going to lose his good eye, he showed gradual improvement. He finally went for eight months without any spells of blindness. His only ocular treatment was a full correction for the refractive error.

TREATMENT

As has been stated, patients with ocular complaints fall within one of three groups: (1) patients with simple neurosis, (2) patients with psychosomatic conditions and (3) patients with strictly organic disorders. The symptoms of the three groups may be identical. None of the patients can be treated until after careful and complete ophthalmic examination of the external eye, the muscular balance, the ocular fundus and the visual field, followed by cycloplegic refraction, and often postcycloplegic study in patients under 40.

There is no routine simplified form of treatment for any of these three groups of patients. For patients with the anxiety type of neurosis with absolutely normal ocular findings the treatment is one of reassurance by the ophthalmologist. Relaxation of the ciliary mechanism is a powerful sedative to the overactive autonomic system of some of these highstrung patients. In the event of persistently recurrent symptoms the patient must be referred to the psychiatrist.

There are two equally poor methods of treatment used in cases of ocular neurosis in which the neurosis is not properly evaluated.

One extreme of poor treatment is illustrated in the case of a patient with simple myopic astigmatism who was told by his optometrist in civilian life that he would have been blind in another three months if he had not been fitted with glasses. The anxiety state, of course, fed on this fear. Complete ophthalmic studies revealed vision of about 20/40 with correction during the state of anxiety tension, but at other times of 20/20. Glasses were necessary for the correction of the myopia, but psychotherapy in the form of a discussion of his condition was most important.

The other objectionable method of treatment is that of labeling such patients malingerers and considering them deserving of disciplinary action. The stigma of being classed as a malingerer adds to the anxiety state. The feeling that some disease is present, though undiagnosed, also increases the anxiety.

The subjective findings here resemble those in many other ocular diseases. A complete ophthalmic examination is always indicated as the primary diagnostic step, and also as a foundation for the proper therapeutic approach. A general physical examination may be indicated if suspicion is aroused concerning actual organic disease or focal infection. It is a serious mistake not to recognize pathologic conditions in these patients. The patient must be told gently but frankly that his symptoms are without organic foundation. If he is inadvisedly given glasses or eye drops are prescribed to help clear up the spots, the neurosis persists and usually is aggravated. Most of these persons have a high order of intelligence and insight and respond well to therapy of the chronic anxiety state; but eye drops will never cure the spots before their eyes, and glasses only "make them see the spots better."

These patients need reassurance, and they must be taught to have insight into their own problems. Over the course of years an annual physical or ophthalmic examination is advisable. Often an anxiety neurosis may be kept in the early stages by proper handling. If the neurosis is improperly handled or the patient subjected to stress beyond his capacity to sustain, the condition will go on to anxiety with exhaustion, or even to severe acute anxiety.

In treatment of hysteria and the obsessive state, ophthalmic examination is necessary to rule out organic disorders, but when this has been done, the patient should be referred to a psychiatrist.

In cases of the anxiety type of neurosis with a small refractive error it is necessary to evaluate the degree of anxiety as well as the degree of refractive error. Often a patient with this type of neurosis does well after a frank disclosure of the neurosis, and he often will agree that he recognizes his nervous temperament. In addition, correction of the refractive error is often an aid in

relieving the patient of some of his symptoms. Most of the patients with an anxiety neurosis received no glasses unless they stated that they could not get along without them. In some of these persons the use of glasses amounted to an obsession. It is impossible to make it a rule to correct only errors of 1.00 D. or over or to draw any other arbitrary line on one side of which symptoms are considered to have an organic basis and on the other side of which they are thought to be psychoneurotic.

In dealing with large refractive errors of the hypermetropic type, should the psychoneurotic patient be given a full correction for an error which in a normal patient would be corrected by only 50 per cent of the cycloplegic findings? Here, again, it is impossible to make a fast rule.

It has been a common procedure to correct smaller errors in private practice than in the more socialized Army practice. More time is available and is required in treating the private patient. The decision rests with the refractionist, and an important fact to be considered is the actual state of the accommodation. In cases of less than average accommodative power more correction is indicated. Duane's table of average accommodative power is an important adjunct to the Prince rule. On the assumption that fatigability is a finding and a symptom of neurosis, the full correction of hypermetropic refractive error has considerable weight in its favor.

It has been our practice to correct all cylindric errors over 0.50 D. and to correct myopia fully.

Many patients with large refractive errors come in for examination without any ocular complaints. I have never seen a neurotic patient with a large refractive error which gave him no symptoms. Most of the patients with neuroses have small refractive errors or orthometropia.

Among the patients with neuroses one encounters occasionally a variable hyperphoria. It varies from day to day and also varies with the administration of a cycloplegic. It has been our practice not to give vertical prismatic correction to any patient unless the hyperphoria remained constant. These patients were normal in regard to function of the ocular muscles. None of them showed even mild paresis of extraocular muscles. Do these patients belong in the neurosis group or in the psychosomatic group? The overactive autonomic nervous system may possibly be the cause of the variable hyperphoria, as with cardiac neuroses there is sometimes tachycardia or irregular rhythm.

Orthoptic treatment of such patients has much in its favor providing the patient understands his underlying neurosis. Prismatic glasses are not to be considered.

The treatment of neurosis does not include surgical intervention. For patients with psychosomatic states with a considerable psychic element an elective surgical procedure is contraindicated. In these patients temporary improvement is often seen after an operation, but the neurosis recurs later, to make the physician regret that an operation had ever been performed. These patients do best with medical treatment of their ocular defect and with psychiatric consultation.

ELECTRON MICROSCOPIC OBSERVATIONS ON BACTERIOLYSIS PRODUCED BY LYSOZYME OF TEARS

B. BABUDIERI, M.D.
Assistant Professor of the Bacteriological Laboratory, Institute of Public Health, Rome
AND
G. B. BIETTI, M.D.
Professor of Ophthalmology, Royal University of Sassari
ROME, ITALY

Lysozyme is a substance in tears, described by Fleming [1] in 1922, which has a strong lytic action on certain organisms. It is also found in nasal mucus and in saliva, but it is especially abundant in egg white, tears and leukocytes.

Lysozyme is characteristically a ferment: It is water soluble, will not pass through a semipermeable membrane and is destroyed by boiling water but not by light or drying. Its optimum action in a neutral medium is attained at 56 to 60 C.

Lysozyme even in high dilutions destroys many saprophytes of the air and is, therefore, thought to have the function in the eye of keeping the conjunctival sac free from atmospheric organisms. The significance of lysozyme for pathogenic organisms is debatable,[2] but Ridley [3] maintained that it does prevent the growth of some organisms.

For further details on the lytic principle of tears, the reader is referred to the works of Fleming,[1] Fleming and Allison,[4] Ridley,[5] Wolff,[6]

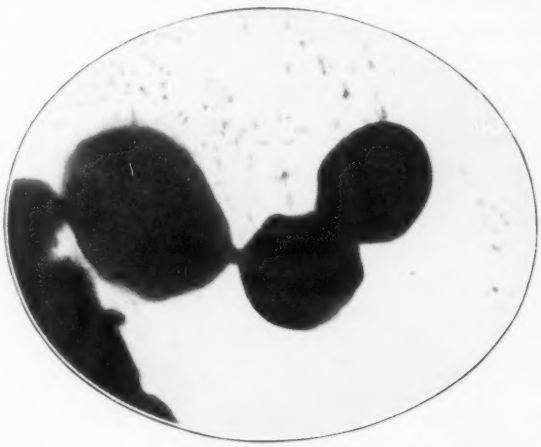


Fig. 1.—Normal appearance of the cocci (from air) in saline solution. × 19,400.

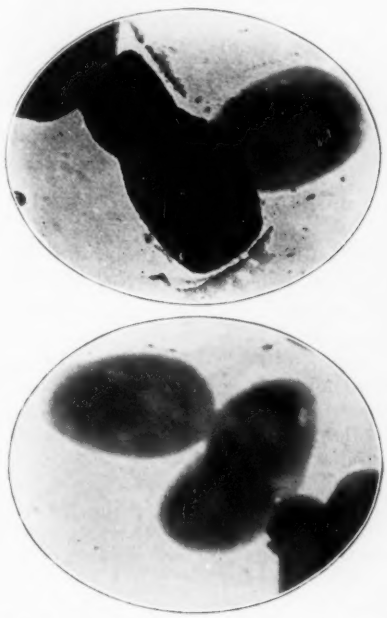


Fig. 2.—Cocci in the first phase of lysis with lysozyme. × 19,400.

From the Institute of Public Health, Rome, Italy.

1. Fleming, A.: On a Remarkable Bacteriolytic Element Found in Tissues and Secretions, Proc. Roy. Soc., London, s.B **93**:306, 1921-1922.

2. (*a*) Callerio, C.: Studi sul lysozym, Boll. d. Soc. med.-chir., Pavia **46**:699, 1932. (*b*) Venco, L.: Ricerche sul lysozym nelle lacrime, Rassegna ital. d'ottal. **2**:519, 1933.

3. Ridley, F.: Lysozyme: An Antibacterial Body Present in Great Concentration in Tears, and Its Relation to Infection of the Human Eye, Proc. Roy. Soc. Med. (Sect. Ophth.) **21**:55, 1928.

4. Fleming, A., and Allison, V. D.: Further Observations on a Bacteriolytic Element Found in Tissues and Secretions, Proc. Roy. Soc., London, s.B **94**:142, 1922-1923; On the Development of Strains of Bacteria Resistant to Lysozyme Action and the Relation of Lysozyme Action to Intracellular Digestion, Brit. J. Exper. Path. **8**:214, 1927.

5. Ridley, F.: The Tears (Lysozyme), in Ridley, F., and Sorsby, A.: Modern Trends in Ophthalmology, London, Butterworth & Co., Ltd., 1940, p. 383; footnote 3.

6. Wolff, L. K.: Untersuchungen über das Lysozym, Ztschr. f. Immunitätsforsch. u. exper. Therap. **50**:88, 1927; **54**:188, 1927.

Nakamura,[7] Andersen,[8] Hallauer,[9] Čavka and Prica,[10] Callerio [2a] and Venco [2b] and Caselli.[11]

Lysozyme differs from bacteriophage in that it is not self reproductive and is not used up during the process of lysis. The spontaneous reproduction of bacteriophage is evident by its spread through a bacterial culture, as shown by the clear spots on the surface of the culture. Lysozyme also differs from bacteriophage in that it is not specific for living organisms, as is bacteriophage.

Ruska's recent observations on bacteriophage with the electron microscope have shown that the bacteriolysis is produced by the agent of the Twort-d'Herelle phenomenon. These recent observations induced us to make a similar study on lysozyme with the electron microscope so that we could compare the bacteriolytic action of lysozyme with that of bacteriophage. Further studies in this field, such as electron microscopic observations on the behavior of aging in organisms and on some other forms of lysis (distilled water, bacteriolysis and peptic digestion), have not been possible because the electron microscope of the Superior Institute of Public Health was, in the first days of October 1943, taken to Germany by order of the German military authorities.

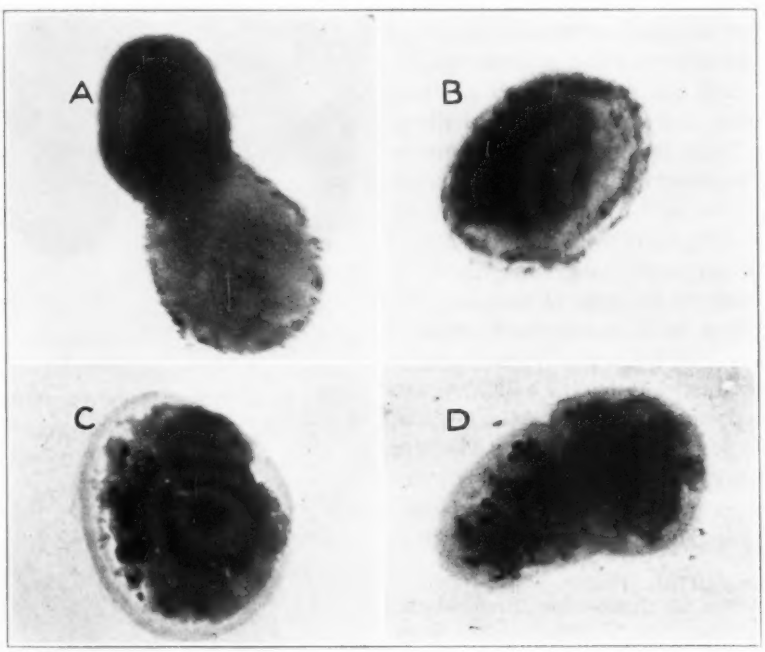


Fig. 3.—Cocci in the second phase of lysis with lysozyme. *A*, × 18,200; *B* and *C*, 19,400; *D*, 18,200.

TECHNIC

We were unable to obtain strains of Micrococcus lysodeikticus, which Fleming isolated from the air and which is relatively sensitive to lysis. We used, instead, two strains of gram-negative cocci of the sarcina type, which produce a pink-yellow pigment (fig. 1). These were isolated from the air and were particularly sensitive to the action of lysozyme.

Twenty-four hour agar colonies of these organisms were emulsified in tears diluted with isotonic saline solution in proportions of 1 : 50 and 1 : 200. Tears were obtained by mechanical irritation of the conjunctiva. The bacterial emulsions were mixed with tears and incubated in a test tube at 37 C. Samples were taken at different times, from fifteen minutes to three hours, and the degree of lysis was determined. As a control, an emulsion of organisms was used without tears. As soon as the sample was taken from the incubator, a few drops of fixative in the form of a 10 per cent concentration of solution of formaldehyde U. S. P. or of 1 per cent osmic acid was added. The fluid in the test tube was centrifuged at a rate of 10,000 revolutions per minute for twenty seconds, the supernatant fluid withdrawn and the sediment washed with distilled water. This process was repeated three times. The washed sediment was then examined with the electron microscope.

7. Nakamura, O.: Ueber Lysozymwirkungen, Ztschr. f. Immunitätsforsch. u. exper. Therap. **38**:425, 1923.

8. Andersen, O.: Untersuchungen über das Lysozym aus dem Micrococcus lysodeicticus, Ztschr. f. Immunitätsforsch. u. exper. Therap. **70**:90, 1931.

9. Hallauer, C.: Ueber das Lysozym, Zentralbl. f. Bakt. (Abt. 1) **114**:519, 1929; Klinische und experimentelle Untersuchungen über dem Lysozymgehalt in Bindehautsack u. in der Tränenflüssigkeit, Arch. f. Augenh. **103**:199, 1930.

10. Čavka, V., and Prica, M.: Ueber Lysozymwirkung in normalen und pathologischen Augensekreten, Arch. f. Ophth. **121**:740, 1929.

11. Caselli: Ricerche sulla bacteriolisi: Dimostrazione dei germi dopo la lisi da lisozima, Boll. d. Ist. sieroterap. milanese **22**:336, 1943.

RESULTS

The following three successive phases of lysis produced by lysozyme could be identified with the organisms used:

In the first phase there was a rarefaction of the bacterial protoplasm. This was incomplete and not uniform. Areas of thinning were clearly visible at the periphery of the bacterial body (fig. 2).

In the second phase the protoplasm became greatly fragmented, especially at the periphery, and showed particles of various sizes. In some cases these were placed close to the bacterial membrane, like the beads of a rosary. The organism tended to swell, a phenomenon previously observed by Fleming; the bacterial membrane became demarcated and seemed intact, and a

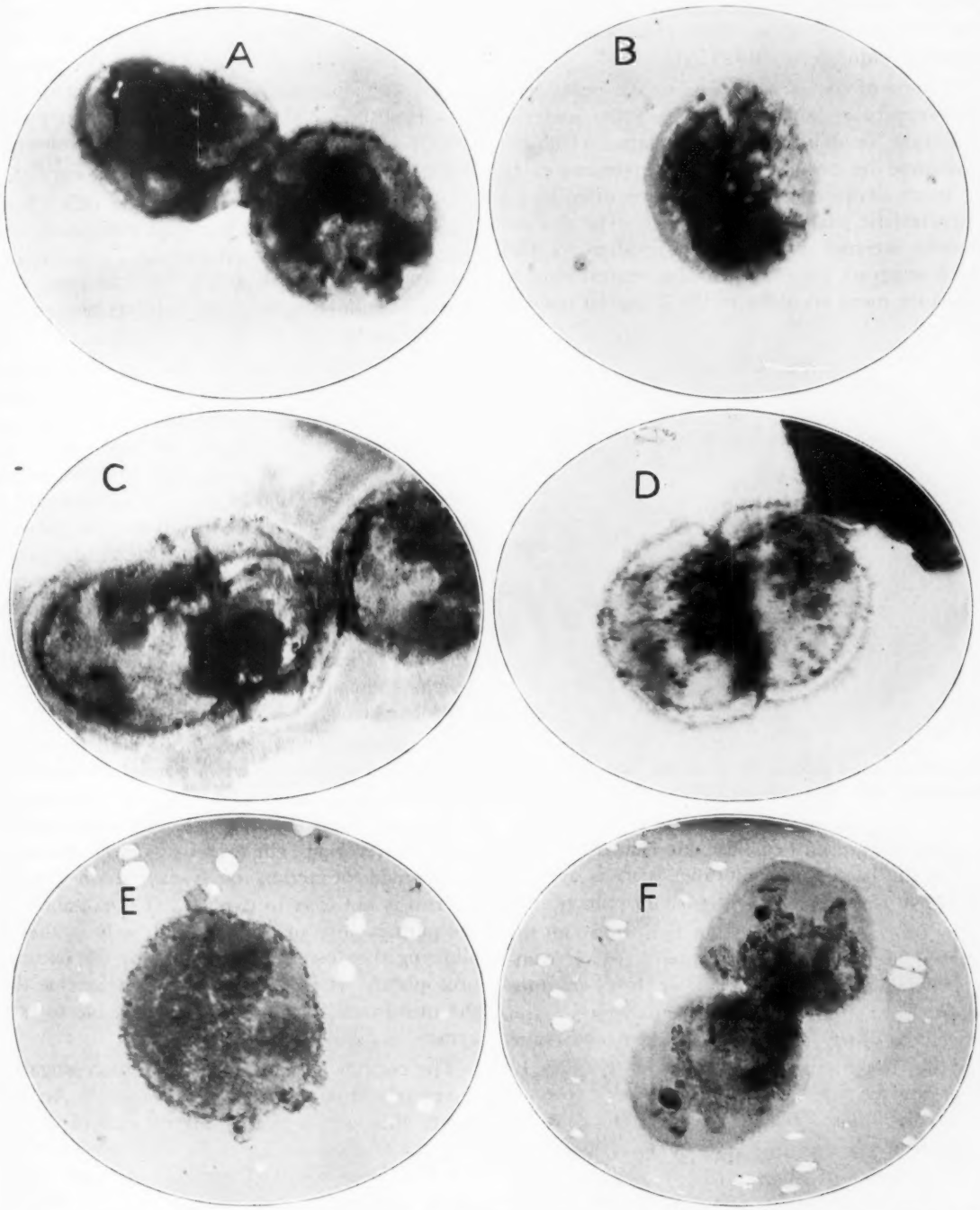


Fig. 4.—Cocci in the third phase of lysis with lysozyme. *A* and *B*, × 18,200; *C*, *D*, *E* and *F*, × 19,400.

transparent space appeared below the membrane (fig. 3).

In the third phase the fragmentation of the protoplasm had advanced to total plasmolysis. The body of the bacteria had swollen to various degrees, being extreme in some and only moderate in others (fig. 4). The sac formed by the bacterial membrane was intact and became almost transparent. It contained amorphous protoplasmic residues (figs. 4 *D* to *F*).

In none of the three phases was it possible to observe protoplasm passing out of the bacterial membrane or dehiscence of the latter. But the membrane did not have a normal appearance. In the more advanced stages of lysis it often had a characteristic shagreen appearance. We did not observe internal protoplasmic residues, a fact which suggests the presence of a central nuclear substance more resistant to the lysis. In none of the phases were any corpuscular elements found outside the bacterial membrane, such as are observed with lysis produced by bacteriophage.

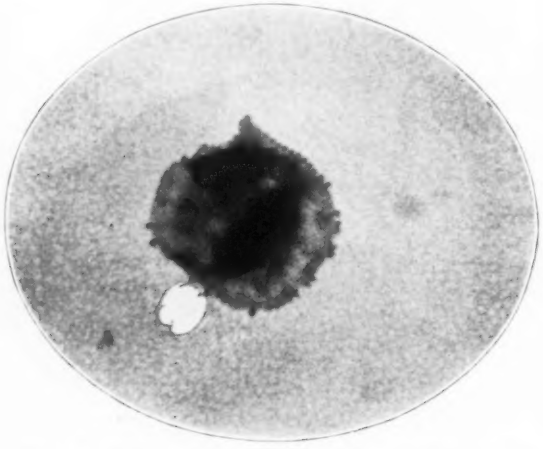


Fig. 5.—Bacteriophagia of a coccus, which appears surrounded with bacteriophage bodies.

The process of lysis was not uniform in all the bacteria. Only after several hours was it complete for all the organisms. After thirty minutes bacteria in the last stages of lysis were found adjacent to others which were still intact. There were no consistent morphologic differences in the organisms fixed with the solution of formaldehyde and those fixed with osmic acid.

The conspicuous difference in lysis produced by lysozyme and that produced by bacteriophage was the absence of the round or cylindric bodies found outside the bacterial body with bacteriophage and considered by Ruska as living elements (figs. 5 and 6). The absence of these forms with lysozyme confirms the idea that lysozyme is a ferment and is clearly different from bacteriophage. This observation is consistent with the hypothesis that bacteriophage is a true living organism.

There are morphologic differences in the bacterial body dissolved by bacteriophage and that dissolved by lysozyme. In the lysis of bacteriophage there is no evident fragmentation of protoplasm, as is evident in the photographs here reproduced and in those of Ruska. The bacterial membrane apparently remains intact with both agents, although there may be some change in its permeability, as has been previously observed with the action of bacteriophage.

Sulfonamide compounds, on the other hand, cause dihiscence of the bacterial membrane, with escape of altered protoplasm (fig. 7), a phenomenon lacking in the action of lysozyme. The action of sulfonamide compounds has been studied by Gärtner.[12]

Aging of the organisms also produces alterations in the bacterial protoplasm. We were unable to study the aging process in the two strains of cocci employed in our studies with lysozyme. We have, however, noted previously in other organisms that the granular fragmentation observed in the bacteriolysis produced by lysozyme does not take place in old organisms; instead, the protoplasm tends to become uniformly transparent while inside the bacterial body, and the nuclear bodies (fig. 8) may then be distinguished (third stage of Piekarski and Ruska). The photographs show spontaneous lysis in old cultures of photobacterium (Coccobacillus pierantonii).

The membrane appears intact, and the protoplasm presents characteristic granular fragmentation inside the bacterial body or some filamentous forms and a nucleus-like mass of undetermined significance. Since the organisms swell, the exact mechanism of action of lysozyme on the organism is not easy to explain. It is possible that the permeability of the bacterial body is altered, allowing the absorption of water by the bacterial protoplasm. It is also necessary to assume that the membrane is or becomes permeable to lysozyme.

The conclusions drawn from our investigation are clearly opposed to those of Caselli.[11] According to this author, the disappearance of the organisms after a specific lysis is an artefact, since it is possible to render them evident under appropriate conditions, such as prolonged staining or the addition of certain chemical substances to

12. Gärtner, K.: Die Sulfonamidwirkung im Lichte der Fluoreszenz und Elektronenmikroskopie, Zentralbl. f. Bakt. (Abt. 1) **150**:97, 1943.

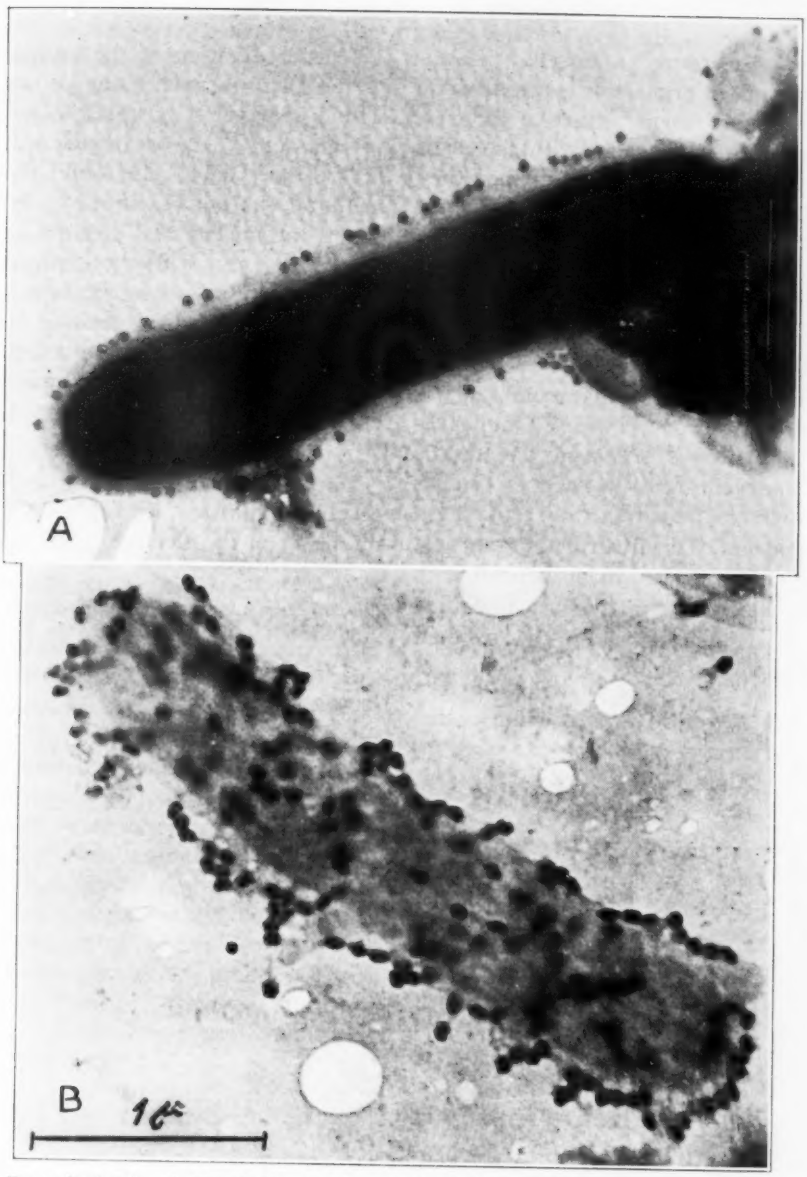


Fig. 6.—Bacteriophagia of Eberthella typhi. *A*, × 30,500; *B* (reproduced from Ruska), 31,500.

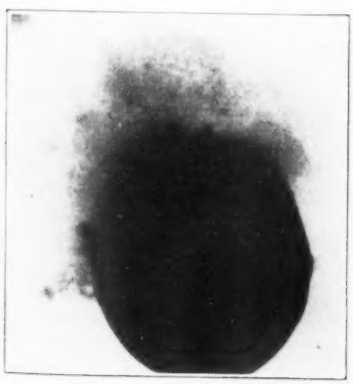


Fig. 7.—Staphylococcus aureus undergoing lysis with a sulfonamide drug (from Gartner [12]). × 38,000.

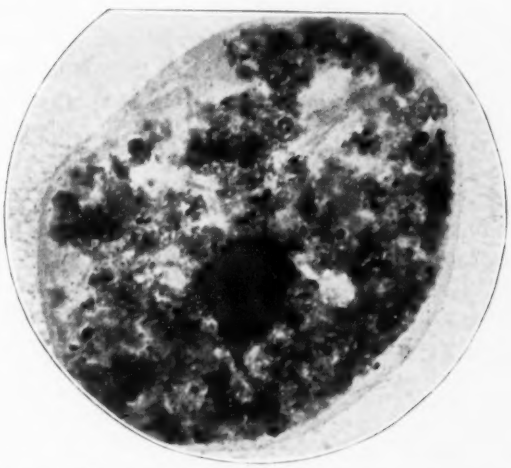


Fig. 8.—Spontaneous lysis of an aging organism (C. pierantonii).

the suspension. According to Caselli, the apparent disappearance of organisms is actually due to the modification of their refractive indexes, rendering them indistinguishable with the ordinary microscope from the medium in which they are suspended. But the pictures obtained with the electron microscope, which records the density of objects, shows that Caselli's opinion is not tenable.

Under the action of lysozyme, the bacterial body is actually dissolved, and only the altered cell membrane persists. If this membrane is treated extensively, it becomes colored and gives the picture of a destroyed organism, and this is what Caselli observed. This change is evident from Caselli's own results obtained by centrifugation of the suspension of disintegrated organisms. The sedimentation of organisms suspended with lysozyme is evidently due to the fact that they are not real organisms but only the residual membranes, which are lighter than the entire organisms.

Our observation of the morphologic integrity of the bacterial membrane of organisms treated with lysozyme is, however, consistent with that of Boasson,[13] who examined stained organisms in the dark field. He found that the bacterial membrane is not destroyed by lysozyme but becomes permeable to protoplasm. We cannot agree, however, with the expressed opinion that a swelling of the bacterial body, previously observed by Kigasawa, is lacking or that the swelling of the bacterial membrane is due to a mechanical artefact, which occurs when the smear is made.

SUMMARY

Successive morphologic stages in the lysis of certain organisms with lysozyme were studied by means of the electron microscope.

Prof. D. Bocciarelli, of the Physical Laboratory of the Superior Institute of Public Health, furnished technical help for the work with the electron microscope.

13. Boasson, E. H.: Bacteriolysis by Lysozyme, J. Immunol. **34**:281, 1938.

PENICILLIN THERAPY OF INFECTIONS OF THE VITREOUS

LUDWIG von SALLMANN, M.D.
NEW YORK

The distribution and depletion of penicillin after intravitreal injection into the rabbit eye, as well as the irritation and damage caused by the drug, were described in previous papers.[1] The therapeutic effect of such treatment was studied on an experimentally induced staphylococcic infection of the vitreous and was compared with that observed after similar therapy with sulfonamide compounds. One or two injections of a solution containing 2.5 mg. of sodium penicillin per cubic centimeter were given.[2] Although the penicillin was not titrated according to the Oxford method, it was estimated that this fraction had an approximate activity of 1,000 Oxford units per milligram.

These studies established the necessity for further investigations to determine the extent to which dosage could be reduced and damage confined to a minimum without curtailing the therapeutic effect. For this purpose, experiments were conducted on infections of the vitreous with a mannitol-fermenting strain of Staphylococcus aureus and a strain of Diplococcus pneumoniae type III. In view of the practical aspect of the direct injection of penicillin into the vitreous, it was advisable to use commercial preparations of the drug.[3]

PRELIMINARY EXPERIMENTS

In preliminary investigations the toxicity of various dilutions of sodium penicillin obtained from two pharmaceutical companies was tested.[4] As a rule 50 to 500 Oxford units of sodium penicillin in 0.1 cc. of solution was injected into the vitreous. With this amount of fluid, withdrawal of aqueous was avoided; otherwise the technic was the same as that described in former publications.[1] The eyes were examined regularly with the ophthalmoscope and the slit lamp and were usually removed for histologic study after seven weeks. A few of the rabbits succumbed to the summer heat of last year, and their eyes were enucleated as soon after death as possible.

Twenty-six eyes of chinchilla rabbits were studied. The clinical and histologic observations are presented in table 1. A traumatic cataract was accidentally produced in 2 eyes by injury of the posterior capsule with the needle. Fine deposits in the anterior part of the vitreous were frequently visible with the slit lamp. Both eyes of the only rabbit which had been given injections of 0.2 cc. of the solution, after withdrawal of aqueous, showed moderate diffuse cloudiness of the vitreous four days later, but the condition could not be observed longer because of the intercurrent death of the animal. Slight edema of the retina in an area adjacent to the lower border of the optic disk was noted in 2 eyes which had received 250 and 500 Oxford units respectively. Histologically 3 of the 26 eyes presented pathologic changes in the retina consisting of isolated areas of atrophy or degeneration not exceeding ½ disk diameter. Two of these globes had been given injections of 250 Oxford units of penicillin from one of the pharmaceutical companies; the third eye had received 500 Oxford units from the second source. The vitreous in 2 eyes contained a small number of inflammatory cells.

A comparison of the published results of toxicity experiments with purified fractions of penicillin of a similar concentration, prepared in the laboratory of Dr. Karl Meyer, and observations in the present series showed in the latter a considerably lower incidence and lesser extent of retinal lesions. Lenticular opacities were absent

This study was supported by the Knapp Memorial Foundation.

From the Department of Ophthalmology, Columbia University College of Physicians and Surgeons, and the Institute of Ophthalmology, Presbyterian Hospital.

1. von Sallmann, L.; Meyer, K., and Di Grandi, J.: Experimental Study on Penicillin Treatment of Ectogenous Infection of the Vitreous, Arch. Ophth. **32**:179 (Sept.) 1944. Dunnington, J. H., and von Sallmann, L.: Penicillin Therapy in Ophthalmology, ibid. **32**:353 (Nov.) 1944.

2. The penicillin was extracted and highly purified in the laboratory of Dr. Karl Meyer.

3. This investigation was reported on in abstract at a meeting of the New York Ophthalmological Society on Nov. 13, 1944.

4. The penicillin was provided by the Office of Scientific Research and Development from supplies assigned by the Committee on Medical Research for experimental investigations recommended by the Committee on Chemotherapeutics and Other Agents of the National Research Council.

in the present series except in the eyes with traumatic cataract, and the inflammatory changes in the vitreous were negligible. Variations in the nature of the samples of penicillin, the alcohol content and the greater amount of fluid used in the injections in the first study may have contributed to the differences in the results of the two series. In the present study the infrequent occurrence of degenerative changes in the retina was also in contrast to the regular appearance of chorioretinal atrophy described by Leopold and Scheie,[5] after intravitreal injections of various microcrystalline sulfonamide compounds and reported later by workers in this laboratory after similar injections of sodium sulfacetimide. In view of the observations reported here on the use of commercial sodium penicillin, theoretic objections to intravitreal treatment in cases of exogenous infection of the posterior segment are further invalidated.

perimental procedure was otherwise as described in previous papers. A time interval of eight hours was selected in all experiments for uniformity. A sufficient number of infected control eyes did not receive any treatment. In general the animals were under observation for five to nine weeks, but 25 per cent died of the summer heat. Clinical examinations with the slit lamp and the ophthalmoscope were made regularly during the period of observation, and the necessary histologic study of the globes with various stains completed the record except for the animals which died unexpectedly and could not be autopsied shortly after death. The course of the infection, the result of the treatment and the histologically observed damage were surveyed and the data tabulated in each instance.

Results.—The preparations of penicillin from the different sources were almost equally effective, so that it was unnecessary to record the results separately. In this series, 84 eyes were infected, of which 24 were untreated controls. The inflammation in the control eyes always led to phthisis bulbi. Twelve of the 60 treated eyes were removed early because of the incidental sickness or death of the animal. Despite the short period of observation in these experiments, the results could be evaluated with probability, since the course of the infection in the first few days was prognostically significant.

TABLE 1.—*Damage to Lens, Vitreous and Retina After One Injection of Commercial Sodium Penicillin in Vitreous of Normal Rabbits*

Source of Penicillin	Oxford Units in 0.1 Cc.	No. of Eyes Observed		Lens		Vitreous		Retina	
		For 7 Weeks	Less Than 2 Weeks	Clear	Traumatic Cataract	Clear	Exudate	Normal	Localized Atrophy
Company A	100	4	2	5	0	4	2*	5	1
	250	2	2	3	1	4	0	2	2
Company B	50	4	0	3	1	4	0	4	0
	100	2	2	4	0	4	0	4	0
	250	4	0	4	0	4	0	4	0
	500	2	2	4	0	4	0	4	0

* Animals received 0.2 cc. after withdrawal of aqueous.

STAPHYLOCOCCIC INFECTIONS OF THE VITREOUS

The value of commercial sodium penicillin when injected into the vitreous in various concentrations was first studied with staphylococcic infections of the posterior segment of the eye. The same mannitol-fermenting strain of Staph. aureus used in former experiments [1] was selected for inoculation of the eyes. Its sensitivity to penicillin was similar to that of the Oxford test strain; that is, 0.01 Oxford unit per 0.2 cc. prevented the growth of a 10^{-2} dilution of the culture.

Technic.—A destructive infection was always produced by injecting 0.05 cc. of a twenty-four hour broth culture in a dilution of 10^{-5}. The treatment consisted of one intravitreal injection of 0.1 cc. each of solutions containing 500, 250, 100, 50 and 10 Oxford units respectively of sodium penicillin. The dilutions were made sterilely in a 0.9 per cent solution of sodium chloride with preparations of sodium penicillin from three pharmaceutical companies. The ex-

In the first week the inflammation of the treated eyes involved the anterior segment as well as the vitreous space. Many cells, plastic and fibrinous exudate, an intense flare in the aqueous and pronounced or extreme swelling of the iris characterized this stage. The vitreous was diffusely cloudy and the fundus was obscured, but a red reflex could usually be obtained. In the second week the inflammatory changes regressed and the anterior chamber regained an almost normal appearance. Although the opacities in the vitreous became less diffuse, strands of exudate generally remained during the subsequent weeks. A white mass of exudate was often observed in the lower periphery. Its resorption took several weeks, and a remnant often covered the retina in the form of a gray veil. In later stages involvement of the retina was more fre-

5. Leopold, I. H., and Scheie, H. G.: Studies with Microcrystalline Sulfathiazole, Arch. Ophth. **29**:811 (May) 1943.

quent than in the series described in former papers. There was attenuation or distortion of the medullated nerve fibers or disappearance of the fine marginal striation of these fibers, and in a few eyes a partial or total retinal detachment was noted. Cataractous changes in the lens were noted clinically in 25 eyes. In 5 eyes the cataract was definitely traumatic, and in the remaining eyes injury with the needle could not be excluded. Clinical observations showed that the infection was checked in all but 3 of the treated eyes.

The extent and nature of the damage caused by the infection in the successfully treated globes could be ascertained by histologic examination. The lesions were divided into opacities of the lens, presence of inflammatory cells in various parts of the eye and organized strands and membranes in the vitreous which caused traction folds of the retina or retinal detachment.

TABLE 2.—*Effect of One Intravitreal Injection of Commercial Sodium Penicillin in Various Concentrations on Staphylococcic Infections of the Vitreous*

Oxford Units of Penicillin in 0.1 Cc.	No. of Eyes Observed		Infection			Damage to *							
						Lens			Vitreous		Retina		
	5 Weeks	Less Than 2 Weeks	Definitely Checked	Probably Checked	Not Checked	Clear	Traumatic Cataract	Complicated Cataract or Infective Focus	Few Inflammatory Cells	Many Inflammatory Cells and Strands	Normal	Small Circumscribed Folds	Large Folds or Extensive Destruction
10	10	0	9	0	1	4	2	4	5	4	2	6	1
50	8	2	8	2	0	5	1	2	6	2	3	4	1
100	14	4	14	4	0	12	0	6	14	4	7	7	4
250	10	6	10	5	1	7	2	6	14	1	5	6	4
500	6	0	5	0	1	3	0	2	4	1	2	2	1
	48	12	46	11	3	30	5	20	43	12	19	25	11

* Five eyes were not examined histologically.

The histologic examination usually corroborated the clinical report, although slight inflammatory changes and the formation of traction folds were not always recognized with the ophthalmoscope. The presence of an abscess in the vitreous, as diagnosed clinically in the 3 cases in which penicillin failed, was confirmed in the histologic sections. These eyes had been treated with 10, 250 and 500 Oxford units of sodium penicillin per 0.1 cc. respectively. In general there was no convincing evidence that the extent of postinflammatory lesions depended on the dose administered except in the eyes in which the smallest dose, of 10 Oxford units in 0.1 cc., had been injected. In these eyes the signs of traction on the retina and the optic nerve due to shrinking strands of exudate were almost always present, as the data in table 2 illustrate.

The opacities of the lens were recognized histologically as posterior complicated cataracts in 5 eyes. Injury of the posterior capsule by the needle was identified as the cause in 5 eyes, and an infective focus in the posterior part of the lens was noted in 15 eyes. It could not be determined whether such a focus was produced by the needle during inoculation or by the spread of the infection from the vitreous.

A small number of inflammatory cells, mostly round cells, were present in the posterior chamber and in the vitreous of the majority of the eyes, even in globes enucleated after eight or nine weeks. Cellular elements in various stages of degeneration were seen more frequently in Cloquet's canal, on the surface of the optic disk and on the lower half of the retina than in other areas of the vitreous space. An accumulation of these cells was noted in 12 eyes.

The most serious lesion consisted of fine strands of organized exudate in the vitreous; these strands as a rule were inserted on the retina around the disk and produced traction folds (small in 23 eyes and large in 11 eyes). Extensive retinal detachment, also due to traction, was noted in 4 eyes. Occasionally these strands pulled the optic nerve inward. The remainder of the massive exudate over the surface of the retina, observed clinically, had undergone organization, with formation of connective tissue, which often produced small retinal folds near the ora serrata.

PNEUMOCOCCIC INFECTIONS OF THE VITREOUS

One preparation of commercial sodium penicillin was employed in this series of experiments, in which 48 eyes, including the controls, were used. The number of the controls was limited to 10 eyes because previous experiments had demonstrated the unfailingly destructive course of this type of infection in rabbits. Septicemia and early death occurred relatively often. Both eyes of 19 rabbits, therefore, were treated, and both eyes of 5 rabbits were used as controls. In view of the sensitivity of D. pneumoniae type III to penicillin (growth was inhibited by 0.006 Oxford unit per 0.2 cc.), the minimal dose was reduced to 5 Oxford units per 0.1 cc.

In a supplementary series, 7 eyes were treated by subconjunctival administration of 0.5 cc. of a solution of penicillin containing 2,500 Oxford units. The outcome of this treatment was collated with that of intravitreal injection of a small fraction of this dose.

Technic.—The infection was produced, as in the experiments with Staph. aureus, by the inoculation of 0.05 cc. of a twenty-four-hour broth culture of D. pneumoniae type III in a 10^{-5} dilution. Eight hours later 0.1 cc. each of isotonic solutions of sodium chloride containing 100, 10 and 5 Oxford units of sodium penicillin respectively was administered. The procedure of the simple intravitreal therapy was modified after the first experiments by the injection of an additional small quantity of penicillin solution beneath the conjunctiva at the site of the original inoculation. This change was suggested by the spread of the infection through the extraocular tissue in the path of the needle.

Observations on the eyes with pneumococcic endophthalmitis were not extended beyond five weeks, since the clinical signs of inflammation disappeared within two weeks after injection. Clinical and histologic examinations of the eyes were carried out in a way similar to that in experiments with staphylococci. In the series with subconjunctival injection, 2,500 Oxford units of sodium penicillin in 0.5 cc. of 0.9 per cent sodium chloride was employed, one-half the dose being injected in the upper part and one-half in the lower part of the bulb.

Results.—In the control eyes an intraocular purulent inflammation was fully developed at the end of forty-eight hours; panophthalmitis and phthisis bulbi characterized the subsequent course. The initial signs of the acute endophthalmitis resembled those observed in the eyes with staphylococcic infections. In the first week following the treatment, however, plastic exudate was rarely seen in the contracted pupil, although the number of cells and the flare in the aqueous were often excessive. The iris usually showed moderate swelling and the vitreous a slight cloudiness, which did not completely obscure the landmarks of the eyeground.

In the second week a few cells and a moderate Tyndall sign were still visible in the anterior chamber. The density of the opacity in the vitreous decreased, so that the fundus could be well inspected with the ophthalmoscope. This portion of the eye was normal in 9 of 10 eyes in the group in which 100 Oxford units per 0.1 cc. was injected; in the remaining eye the retina had been torn with the needle, resulting in retinal detachment without inflammatory signs. Histologic examination revealed that the uvea and lens of all eyes were normal and the remnants of inflammation in the vitreous were negligible. The retina was normal in 7 eyes, and small, flat retinal folds were present in the region of the ora serrata in 1 eye. A small chorioretinal scar and the aforementioned tear of the retina in the 2 remaining eyes were obviously caused by trauma and were unrelated to the infection.

TABLE 3.—*Effect of Two Types of Topical Therapy with Commercial Sodium Penicillin in Various Concentrations on Pneumococcic Infections of the Vitreous*

							Damage to								
							Lens			Vitreous			Retina		
Type of Therapy	Dose, Oxford Units	No. of Eyes Observed: 4 to 5 Weeks	No. of Eyes Observed: Less Than 1 Week	Infection: Definitely Checked	Infection: Probably Checked	Infection: Not Checked	Clear	Traumatic Cataract	Complicated Cataract or Infective Focus	Few Inflammatory Cells	Many Inflammatory Cells	Abscess	Normal	Small Circumscribed Folds	Large Folds or Extensive Detachment
Intravitreal injection, 0.1 cc.	5	5	6	1	5	5	7	0	4	3	4	4	6	0	5
	10	6	4	5	2	3	9	0	1	4	4	2	7	0	3
	100	10	0	10	0	0	10	0	0	10	0	0	7	2	1*
Subconjunctival injection, 0.5 cc.	2,500	1	6	0	0	7	Panophthalmitis								

* Traumatic detachment occurred.

Seven of the 10 eyes treated with a solution containing 10 Oxford units per 0.1 cc. displayed equally favorable results, although the number of inflammatory cells in the cortical area of the vitreous and on the optic disk was greater. The period of observation on 1 of the rabbits of this group was limited to one week, when the animal died of a large metastatic subphrenic abscess. The 3 eyes of this group counted as therapeutic failures had definitely benefited from the treatment, but circumscribed purulent exudate had greatly damaged the retina.

When the dose was reduced to one of 5 Oxford units per 0.1 cc., the incidence of failures was further increased. Six of the 11 treated eyes were definitely or probably cured (table 3), and 5 were lost. Two of the rabbits which responded favorably died of septicemia in the first week. Pneumococci were grown in pure culture on plates seeded with heart blood. Histologic examination of the eyes of these animals did not disclose more than a few inflammatory cells in the periphery of the vitreous, so that the local process was considered as probably checked. The

5 globes tabulated as lost showed signs of a beneficial therapeutic effect. Exudative detachment of the retina, however, involved the lower half in 3 eyes and was total in 2 eyes.

The course of the infection in the 7 eyes which were treated by subconjunctival injection did not differ noticeably from that in the untreated controls; that is, abscess in the vitreous, panophthalmitis and phthisis bulbi developed in the rabbits that survived.

COMMENT

Three main conclusions can be drawn from these experiments on penicillin treatment initiated eight hours after vitreal infection. They slightly modify and extend the deductions made in previous papers. First, it was shown that commercial penicillin had a full therapeutic effect in concentrations which did not cause any detectable lesions of the delicate structures of the eye. Second, subconjunctival injection of concentrated solutions of penicillin resulted in complete therapeutic failure. Third, the effectiveness of the intravitreal administration of penicillin in pneumococcic infections of the posterior segment exceeded that observed in staphylococcic infections, especially in regard to the prevention of postinflammatory sequelae.

With reference to the first conclusion, it may be emphasized that previous chemotherapeutic attempts to check or influence such experimental staphylococcic or pneumococcic infections did not meet with success. Von Rötth [6] investigated the effect of the acridine derivatives, rivanol (2,-ethoxy-6,9-diaminoacridine lactate) and acriflavine, and of methenamine when given intravenously. Experimental infections of the vitreous with Staph. aureus and D. pneumoniae were not influenced by the therapy. In earlier studies in this laboratory on a similar standard lesion, intravitreal injection of sodium sulfacetamide combined with systemic therapy with sulfonamide compounds was also ineffective. Moreover, the relative toxicity of the acridine derivatives and the sulfonamide compounds as shown in vitro and in vivo precludes their injection into the vitreous space in suitable concentrations. In contrast, a full therapeutic effect was achieved in experimental infections of the vitreous with a noninjurious amount of penicillin, that is, 0.1 cc. of a solution containing 100 Oxford units.

The larger size of the human vitreous and the moderate damage observed in rabbits with more concentrated solutions of penicillin would indicate that an increase in this dose is permissible in the human eye without undue danger to the retina and lens. Whether larger doses are necessary will depend on the results of extensive clinical and histologic observations. Rycroft injected 1,000 to 5,000 Oxford units of penicillin into the vitreous in 5 patients with war injuries without ill effect.[7] No conclusions can be drawn from this statement, however, since histologic studies were not reported and the toxic effect cannot be evaluated in eyes with long-standing infection. In the usually less acute course of exogenous infections of the human eye, the humoral and cellular defense mechanisms may give greater support to the drug and may even permit a decrease in the minimal effective dose. On the other hand, the proved sensitivity of the infective organisms, the accurate placing of the focus and the relatively short time between the inoculation and the treatment render the experimental infection more suitable for successful topical therapy.

The treatment was not repeated in the present series, since former studies indicated the futility of continued therapy. The course of the inflammatory process after a second injection of penicillin even conveyed the impression that the endophthalmitis was aggravated. In addition, one day after the first treatment the pathologic changes in the unfavorable cases were beyond the stage at which penicillin therapy was successful in our hands. For the same reason, it was inadvisable to repeat the subconjunctival injection in the eyes with pneumococcic endophthalmitis.

Struble and Bellows reported a concentration of 1.9 Oxford units of penicillin per cubic centimeter in the vitreous fluid after subconjunctival injection,[8] whereas little or no penicillin was detected in the experiments of this laboratory with slightly modified technic. It was desirable, therefore, to test the possible effect of such therapy on an infection produced by an organism highly susceptible to penicillin. The study was also suggested by the assertion of Dawson and Hobby [9] that "the estimation of drug levels by necessarily crude methods give

6. von Rötth, A.: Chemotherapy of Septic Endophthalmitis, Magyar orvosi arch. **28**:252, 1927; Chemotherapy in Intraocular Inflammation, Budapesti orvosi ujság **26**:1153, 1928.

7. Rycroft, B. W.: Penicillin and the Control of Deep Intra-Ocular Infection, Brit. J. Ophth. **29**:57 (Feb.) 1945.

8. Struble, G. C., and Bellows, J. G.: Studies on the Distribution of Penicillin in the Eye and Its Clinical Application, J. A. M. A. **125**:685 (July 8) 1944. Bellows, J. G.: Penicillin Therapy in Ocular Infections, Am. J. Ophth. **27**:1206 (Nov.) 1944.

9. Dawson, M. H., and Hobby, G. L.: The Clinical Use of Penicillin: Observations on One Hundred Cases, J. A. M. A. **124**:611 (March 4) 1944.

no information regarding the biological activity of material containing only traces of penicillin." From the complete failures of subconjunctival injections of penicillin in treatment of pneumococcic infections it can be inferred that under the conditions of the experiment low and erratic levels of penicillin were insufficient to cope with an acute infection of the vitreous. The slow diffusion of the drug in the vitreous gel and the acid milieu in acute stages of endophthalmitis probably contributed to the failure. Garrod [10] demonstrated the decline in activity of penicillin with a shift of the hydrogen ion concentration to 5.5, a degree of acidity present in the infected vitreous.[11]

The minimal effective dose of penicillin for infections of the vitreous with a strain of Staphylococcus of medium susceptibility was about 10 Oxford units per 0.1 cc. When the dose was reduced to this amount, the inflammation regressed more slowly than in the eyes treated with higher concentrations of penicillin, and the shrinking exudate in the vitreous was more destructive than in other series. The dependence of the clinical course of the endophthalmitis on the dose was more clearly demonstrated in the pneumococcic infections. Treatment beginning eight hours after inoculation was fully successful with a solution containing 100 Oxford units in 0.1 cc., whereas the treatment was unsatisfactory in 5 of 11 eyes with the introduction of only 5 Oxford units per 0.1 cc.

The postinflammatory sequelae, namely, strands in the vitreous, so frequent after cure of staphylococcic infections, were almost totally absent with pneumococcic endophthalmitis. In experiments now in progress it has been noted that intravitreal injection of the exotoxin from the same strain of Staph. aureus caused the formation of a shrinking exudate similar to that observed in the infection with the organisms. The persistent action of the toxin formed prior to the injection of penicillin may be related, therefore, to the formation of strands in the vitreous.

OBSERVATIONS ON HUMAN EYES

Experimental results were considered as a sufficient basis for treating several patients with perforating injuries and definite or probable infection of the posterior segment.

CASE 1.—J. N., aged 43, was admitted to the Institute of Ophthalmology on Oct. 30, 1944, forty-eight hours after injury to the left eye, with a foreign body in the vitreous and signs of a severe intraocular infection. The lids and conjunctiva were red and edematous, and laceration of the cornea extended from the center upward to the limbus, with circumscribed incarceration of the iris. A hypopyon filled half the shallow anterior chamber; the inflammatory reaction and a traumatic cataract prevented visibility of the eyeground. Vision was reduced to light perception and faulty projection below. Dr. John H. Dunnington removed by the scleral route a magnetic, flat foreign body, 11.5 mm. long and 3 to 4 mm. wide, to which a web of purulent exudate adhered. Two-tenths cubic centimeter containing 200 Oxford units of sodium penicillin was injected through the scleral wound into the vitreous after the sutures were tied. The purulent material of the foreign body and the exudate from the wound were cultured on various nutrient mediums.[12]

The coagulase-positive and mannitol-fermenting strains of Staph. aureus which were isolated were sensitive to penicillin. Because of the involvement of the anterior chamber, penicillin was introduced iontophoretically four times during the subsequent week, and two injections of typhoid vaccine supplemented the topical therapy.

The inflammatory signs subsided gradually. Three months after the injury the eye was white and the cornea clear except for a linear scar in the upper half. A small amount of organized exudate was visible on the surface of the cataractous lens. A red fundus reflex was obtained with the ophthalmoscope, but no details of the fundus were visible. In spite of the cataract, the patient could count fingers and projected the light accurately. Examination one month later gave the same result.

CASE 2.—C. K., aged 62, was admitted two days after injury to the right eye with a wooden slat. Thirty-six hours before admission the patient experienced loss of vision followed by extreme pain. At the time of admission, on Aug. 21, 1944, a perforating wound was present at the limbus above, surrounded by purulent exudate. A hypopyon and a muddy iris were seen through the steamy cornea. The pupil was contracted and drawn toward the wound. Light perception was faulty downward. The red fundus reflex could not be obtained.

On the day of the patient's admission the eye received one iontophoretic application of a solution of sodium penicillin containing 1,000 Oxford units per cubic centimeter (2 milliamperes for five minutes). On the following day, when massive exudate was seen in the vitreous through the dilated pupil, Dr. Maynard Wheeler injected into the vitreous 0.1 cc. of sodium penicillin containing 100 Oxford units. Iontophoresis with the penicillin solution was repeated three times during the subsequent week. Systemic treatment consisted of four injections of typhoid vaccine and oral administration of sulfadiazine.

Cultures of material taken from the conjunctiva two weeks after the patient's admission were negative for pathogens. Cultures made two days later, however, showed a strain of Staph. aureus which was relatively resistant to penicillin. In the weeks that followed the inflammatory symptoms and signs regressed, and the exudate in the vitreous was slowly absorbed. Vision improved to 10/200 and parts of the fundus became visible, but strands of exudate still prevented examination of the disk five months after the accident.[13]

10. Garrod, L. P.: The Action of Penicillin on Bacteria, Brit. M. J. **1**:107 (Jan. 27) 1945.

11. von Sallmann, L.: Hydrogen Ion Concentration of the Vitreous in the Living Eye, Arch. Ophth. **33**: 32 (Jan.) 1945.

12. Dr. Devorah Locatcher-Khorazo did all the bacteriologic work on the human eye.

13. Wheeler, M.: Paper read at the meeting of the New York Ophthalmological Society, Nov. 13, 1944.

CASE 3.—S. P., aged 68, was operated on for cataract of the right eye on Nov. 3, 1943. Small prolapses of the iris pillars were noted postoperatively. On April 3, 1944 the patient complained of heaviness of the right eye during the preceding week. On May 11 she began to see black spots, and the eye became red and painful. She was admitted on the same day, with pronounced swelling of the lids, chemosis and a purulent conjunctival discharge. Pus covered the area of the prolapsed iris. The cornea was hazy, and the anterior chamber contained fibrinous exudate. The fundus reflex could barely be seen, and vision was reduced to light perception and faulty projection. Later the same day 0.2 cc. of a solution of sodium penicillin containing 200 Oxford units was injected into the anterior chamber, after the withdrawal of aqueous fluid, and the same amount was injected into the vitreous. Cultures of the aqueous fluid revealed mannitol-fermenting and coagulase-positive Staph. aureus and a few colonies of non-mannitol-fermenting and coagulase-negative Staph. albus. The sensitivity of the strain of Staph. aureus was low, as 0.25 Oxford unit in 0.2 cc. was necessary to inhibit the growth of the culture. Because of the severe iritis sodium penicillin was applied iontophoretically once a day during the following week. Systemic therapy consisted in the daily administration of 100,000 Oxford units of sodium penicillin for thirteen days, supplemented with four injections of typhoid vaccine. The signs of inflammation regressed; but phthisis bulbi developed, and the eye was enucleated.

CASE 4.—B. F., aged 46, was admitted to the service of Dr. Thomas H. Johnson on Nov. 14, 1944, two hours after the right eye was struck with a piece of glass. In addition to a small cutaneous wound of the brow and a subconjunctival extravasate, there were two perforating, irregular wounds, extending from the lower half of the cornea to the sclera. A small prolapse was present, and swollen lenticular matter protruded into the pupillary area. Ten hours after the accident the prolapsed iris was excised, and 0.1 cc. of sodium penicillin containing 100 Oxford units was injected into the lens and the same amount into the vitreous through the scleral laceration, after the corneal wound had been closed with two sutures. Finally, a conjunctival flap was dissected and sutured to the upper portion of the limbus.

Culture of material taken from the wound prior to operation yielded a mannitol-fermenting and coagulase-positive strain of Staph. aureus. Tests indicated average sensitivity to penicillin.

The subsequent course was uncomplicated except for atropine dermatitis of the lids. Two weeks after the injury the anterior chamber was still absent and light perception was faulty. The eye was enucleated nineteen days after injury. Histologic examination of the eyeball showed an irregular, epithelized wound of the cornea, cataractous changes in the lens and a traumatic defect of the iris. The lens was free from inflammatory changes, and the vitreous and choroid contained only a small number of round cells. The retina and choroid were detached. The retina, which showed hemorrhages on its surface and destruction of the rods and cones due to the detachment, was otherwise normal except for a circumscribed perivascular infiltration of one vessel.

Mannitol-fermenting strains of Staph. aureus were isolated in all cases. It is doubtful, however, whether the staphylococcus cultured from the material of the conjunctiva in case 2 was the cause of the severe endophthalmitis. The strains isolated in cases 1 and 4 had an average sensitivity to penicillin, whereas the strains isolated in cases 2 and 3 had a low sensitivity. Topical penicillin therapy over a period of two weeks may have made the strain in case 2 relatively penicillin fast. The endophthalmitis responded surprisingly well in cases 1 and 2 in view of the advanced stage of the intraocular inflammation and the lapse of more than forty-eight hours between the injury and the treatment. Whether the additional iontophoretic and systemic treatment participated in the unexpected beneficial results cannot be ascertained. It is justifiable to assume, however, that the good effects were achieved mainly by the direct injection of penicillin into the vitreous.

The interval between the beginning of the inflammation and the injection of penicillin was unknown in case 3, but on the patient's admission the eye presented the signs of imminent panophthalmitis, the course of which was modified but not checked by the treatment. The low sensitivity of the infecting organisms to penicillin may also have had a bearing on the therapeutic failure.

The absence of any inflammatory signs in the lens and the slight reaction in the vitreous, retina and choroid in case 4 indicated that the amount of penicillin was well tolerated. It is possible that the intravitreal injection of penicillin prevented the development of endophthalmitis septica (Fuchs), the existence of which was suggested by the dense perivascular infiltration of one retinal vessel.

Rycroft reported the failure of intravitreal treatment with concentrated solutions of penicillin of deep infections of the eye due to penetrating war wounds. His conclusion that such treatment does not influence the course of deep infections was based on the results in 4 cases of abscess of the vitreous, in which periods of seven, twelve, nineteen and thirty-four days respectively had elapsed between the injury and the injection of penicillin. In a fifth case, with a week old injury, the condition was described at the time of treatment as "amounting almost to panophthalmitis." In none of the eyes was the infecting organism identified, nor was a histologic examination mentioned. It seems, therefore, that these eyes were scarcely suitable for an evaluation of the therapy. It is difficult to conceive how any antibacterial agent can be expected to restore or improve the completely lost function of the eye with an old and massive purulent exudate in the vitreous. The fifth case

reported by Rycroft, in which an inflammation amounted "almost to panophthalmitis," can be compared to case 3 and also to cases of experimental infections in rabbits in which the treatment was initiated too late. The response to the treatment in cases 1 and 2 of the present series indicates, however, that the twelve hour limit for satisfactory treatment of experimental exogenous infections can be extended for similar conditions of the human eye and that encouraging results can be obtained after the signs of an alarmingly severe endophthalmitis have appeared.

SUMMARY

1. Intravitreal injections of 100 and 10 Oxford units of commercial sodium penicillin obtained from various sources did not cause any noticeable damage to the retina, lens or optic nerve. The lesions caused by 500 and 250 units of sodium penicillin were negligible.

2. Staphylococcic infections of the vitreous were checked by the injection of 10 Oxford units of sodium penicillin eight hours after inoculation. The therapeutic effect was increased when five to forty times this amount was given. In a considerable percentage of the beneficially treated eyes shrinking strands of organized exudate produced traction folds of the retina.

3. Pneumococcic infections of the vitreous were arrested in all eyes when 100 Oxford units of sodium penicillin was administered eight hours after inoculation. A reduction of the dose to 5 Oxford units led to unsatisfactory results in 5 of 11 eyes. The successfully treated eyes were usually free of postinflammatory sequelae.

4. Pneumococcic infections were not influenced by the subconjunctival administration of 250 Oxford units of sodium penicillin eight hours after inoculation.

5. Two of the 3 patients with severe traumatic endophthalmitis involving the vitreous space responded favorably to intravitreal injection of penicillin despite the advanced stage of the infection and the lapse of more than forty-eight hours between injection and the first intravitreal treatment.

NOTE.—Since this study was completed, an article by Leopold [14] on the intravitreal penetration of penicillin has appeared.

Dr. John H. Dunnington, Dr. Maynard Wheeler and Dr. Thomas H. Johnson permitted the report of their cases.

Mrs. Florence Cardenas assisted in the study.

630 West One Hundred and Sixty-Eighth Street.

14. Leopold, I. H.: Intravitreal Penetration of Penicillin and Penicillin Therapy of Infections of the Vitreous, Arch. Ophth. **33**:211 (March) 1945.

INFLUENCE OF LOCAL APPLICATION OF SULFONAMIDE COMPOUNDS AND THEIR VEHICLES ON REGENERATION OF CORNEAL EPITHELIUM

IRVING H. LEOPOLD, M.D., D.Sc., AND WILLARD H. STEELE, M.D.
PHILADELPHIA

There have appeared excellent reviews by Bellows,[1] Alvaro,[2] Thygeson[3] and Wagener[4] concerning the toxic properties of the sulfonamide compounds on ocular structures. Although much has been written about the toxic influence of these compounds on wound healing elsewhere in the body, only recently has consideration been given to their influence on healing of ocular wounds. Bellows considered this property in his review in June 1943. The data for these conclusions were based on the experimental work of Bellows and Gluckman.[5] These authors concluded that locally applied sulfonamide compounds greatly deter regeneration of corneal epithelium. Berens, De Gara and Loutfallah[6] demonstrated in 1943 that the average healing time of the wounds of the cornea treated with sulfonamide ointment or with the ointment base alone was usually greater than the average healing time of the untreated eyes. They suggested that the local use of the sulfonamide compounds be limited to cases in which chances of infection prevail. They demonstrated a more retarding effect of sulfonamide ointment on the healing of deep wounds than on that of superficial wounds. Smelser and Ozanics[7] reported in October 1944 that sulfonamide drugs differed in their ability to delay epithelial regeneration and that ointment preparations of these compounds did not retard epithelial regeneration as much as powders. Because of the practical importance of sulfonamide compounds in preventing secondary infection in war injuries of the eyes, as well as in civilian ocular lesions, in order that proper emphasis be given to the delay of corneal epithelization by sulfonamide compounds, and in view of the recent interest in this subject, it seemed desirable to report some observations made in 1943.

EXPERIMENTAL STUDY

In order to evaluate properly the influence of sulfonamide preparations on regeneration of corneal epithelium it is necessary to determine the effect of ointment bases and powder bases without the addition of the drug. In the following series both of these problems were considered. Each series consisted of 6 rabbits. All the rabbits were blue-eyed chinchillas, weighing approximately 2 to 2.5 Kg. De Rötth[8] stated that lesions produced by mechanical denudation and involving the limbus are unsatisfactory; it is too difficult to be certain that one is producing constant damage, and therefore the variations are greater. However, this was the type of lesion used by Bellows and Gluckman, and so it was employed here, with the substitution of tetracaine for cocaine anesthesia. In the first experimental series, 6 groups of 6 rabbits were used. All the corneas were stained once daily with 1 per cent fluorescein sodium and irrigated with a minimum of isotonic solution of sodium chloride, care being taken not to direct the fluid on to the corneal surface. In eyes in which any type of ointment or powder was used, applications were made five times daily.

Previous studies have shown that local application of sulfonamide compounds will barely maintain an adequate level of the drug in the aqueous in eyes with epithelium denuded if the drug is applied only every six hours in ointment form.[9] The corneal level is higher than the aqueous level when the sulfonamide

From the Department of Ophthalmology of the University of Pennsylvania.

The work described in this paper was done under a contract, recommended by the Committee on Medical Research, between the Office of Scientific Research and Development and the University of Pennsylvania.

1. Bellows, J. G.: Chemotherapy in Ophthalmology, Tr. Am. Acad. Ophth. **47**:19 (Sept.-Oct.) 1942; Arch. Ophth. **29**:888 (June) 1943.

2. Alvaro, M. E.: Effects Other Than Anti-Infectious of Sulfonamide Compounds on the Eye, Arch. Ophth. **29**:615 (April) 1943.

3. Thygeson, P.: Sulfonamide Compounds in Treatment of Ocular Infections, Arch. Ophth. **29**:1000 (June) 1943.

4. Wagener, H. P.: The Toxic Effects of Sulfonamides on the Eye, Am. J. M. Sc. **206**:261 (Aug.) 1943.

5. Bellows, J. G., and Gluckman, R.: Local Toxic Effects of Sulfanilamide and Some of Its Derivatives, Arch. Ophth. **30**:65 (July) 1943.

6. Bérens, C.; De Gara, P. F., and Loutfallah, M.: Effect of Sulfonamide Ointment on Healing of Experimental Wounds of Rabbit Cornea, Arch. Ophth. **30**: 631 (Nov.) 1943.

7. Smelser, G. K., and Ozanics, V.: Effect of Chemotherapeutic Agents on Cell Division and Healing of Corneal Burns and Abrasions in Rat, Am. J. Ophth. **27**:1063 (Oct., pt. 1) 1944.

8. de Rötth, A.: Local Action of Oils Containing Vitamin A, Arch. Ophth. **24**:281 (Aug.) 1940.

9. Adler, F. H.; Leopold, I. H.; Steele, W. H., and Crandall, A. C.: Unpublished observations.

compound is applied locally and is, therefore, probably adequate with applications every six hours. It was thought that five applications daily would most likely insure higher levels, and so this method was used. Whenever the cornea appeared infected, the animal was discarded and a new one substituted. Four eyes in this first series were thought to be infected, as evidenced by a gray sloughing corneal infiltrate and pronounced pericorneal injection, rapidly proceeding to involvement of the remainder of the cornea and hypopyon formation. No sulfonamide-treated eye underwent such changes in this group.

The vehicles used in this first group were Friedenwald-Fuqua[10]; hydrous wool fat and petrolatum, 50 per cent each; Aquaphor,[11] and sterile calcium carbonate powder, one of the substances poorly soluble in water used by Wallace and Tiernan to prepare their buffered sulfanilamide. The sulfonamide compounds used were (1) sodium sulfadiazine, 10 per cent in hydrous wool fat-petrolatum ointment; (2) microcrystalline sulfadiazine, 10 per cent in Friedenwald-Fuqua ointment, and (3) 100 per cent buffered sulfanilamide.[12]

It is evident that by the fourth day 67 per cent of the eyes with simple denudation, 38 per cent of the eyes treated with ointment base or powder base alone and 42 per cent of the sulfonamide-treated eyes had completely regenerated. Analysis of these statistics by computation of chi square,[13] however, indicates no significant difference in healing between eyes treated with an ointment base and eyes with simple, untreated, denudation; between sulfonamide-treated eyes and eyes with simple denudation, and between eyes treated with an ointment base alone and sulfonamide-treated eyes.

By the fifth day 92 per cent of the eyes with simple denudations, 50 per cent of the eyes treated with ointment base or powder base alone and 42 per cent of the sulfonamide-treated eyes had completely regenerated. Analysis here by

TABLE 1.—*Influence of Ointments, Powders and Sulfonamide Preparations on Mechanical Denudations Involving the Limbus*

Day of Regeneration	No. of Eyes Whose Epithelium Had Regenerated on Indicated Days												Incidence of Scars
	3	4	5	6	7	8	9	10	11	12	13	14	
Simple denudation	2	2	1	..	..	1	..	..	..	..	..	..	1
Sulfadiazine, microform, 10% in F-F* ointment	..	4	..	..	..	..	2	..	..	..	..	..	..
Friedenwald-Fuqua ointment	..	1	2	..	..	..	1	1	1	..	..	..	2
Sulfadiazine, microform, 10% in F-F ointment	2	1	..	..	..	1	2	..	..	..	..	..	..
Hydrous wool fat-petrolatum base, 50% each	3	2	..	..	..	..	..	..	..	..	..	..	..
Sodium sulfadiazine, 10% in L-P,† 50% each	3	2	..	..	..	..	1	..	..	..	..	..	..
Microcrystalline sulfadiazine powder	1	..	..	1	1	3	..	..	..	..	..	..	1
Sodium sulfadiazine, 10% in L-P, 50% each	1	..	..	1	4	..	..	..	..	..	..	..	..
Buffered sulfanilamide	..	..	..	3	2	..	..	..	1	..	..	..	2
Calcium carbonate alone (sterile)	..	..	..	..	..	..	..	..	2	2	1	1	2
Simple denudation	1	3	2	..	..	..	..	..	..	..	..	..	..
Aquaphor alone	..	2	1	..	..	..	1	1	1	..	..	..	..
Totals													Total No. Eyes in Each Group
Simple denudation	3	5	3	0	0	1	..	..	..	..	..	..	12
Ointment base and powder base control	3	6	5	0	0	0	2	2	4	2	1	1	24
Sulfonamide drugs in ointment and powder base	7	8	9	5	7	4	3	1	1	..	..	..	36

* Friedenwald-Fuqua ointment.
† Hydrous wool fat-petrolatum base.

The data from this first series of experimental studies are contained in table 1. The results are recorded in pairs, representing what was done in the 12 eyes of each series of 6 rabbits. The totals for each method of treatment, showing the number of eyes which had completely regenerated on each day, are recorded at the bottom.

computation of chi square showed a significant difference between sulfonamide-treated eyes and eyes with simple denudation and between ointment-treated eyes and eyes with simple denudation; it may be concluded, then, that both ointment and powder alone, as well as sulfonamide-containing ointments and powders, deter epithelial regeneration as compared with no therapy at all. On the same day the sulfonamide compounds showed a slightly greater deterring in-

10. Friedenwald-Fuqua ointment consists of benzyl benzoate, 5 per cent; peanut oil, 37 per cent; wool fat, 8 per cent; cetyl alcohol, 10 per cent; glycerin monostearate, 10 per cent; white petrolatum, U. S. P., 25 per cent.

11. Aquaphor consists of petrolatum, 95 per cent, and cholesterol and its esters, 5 per cent.

12. Buffered sulfanilamide consists of sulfanilamide U. S. P., 75 per cent; calcium carbonate, 10 per cent; urea, 9.5 per cent; disodium phosphate, 5 per cent; sodium tetradecyl sulfate, 0.3 per cent, and chloroazodin, 0.1 per cent.

13. In order best to eliminate the factor of chance in these statistics, Dr. Harold Austin advised the application of the chi square statistical analysis to these data (Hill, A. B.: Principles of Medical Statistics, ed. 2, London, The Lancet, Ltd., 1939, p. 78-96. Peters, C. C., and Van Voorhis, W. R.: Statistical Procedures and Their Mathematical Bases, School of Education, State College, Pa., 1935, pp. 404-423). A t of 0.05 was used in these studies.

fluence on regeneration than did the ointment bases alone, as analyzed by computation of chi square. By the eighth day 100 per cent of the eyes with simple denudation, 50 per cent of the eyes treated with ointment base or with powder base alone and 84 per cent of the sulfonamide-treated eyes had completely regenerated. At this time there was still evidence by computation of chi square that sulfonamide compounds deter epithelial regeneration. However, on this day it appeared that the ointment base and the powder base deterred healing significantly more than the sulfonamide preparations. By the eleventh day 100 per cent of the sulfonamide-treated eyes were also healed, but the eyes treated with ointments and powder bases were not all healed until the fourteenth day.

There was no significant difference in the incidence of scarring between eyes treated with ointment base or powder base and sulfonamide-treated eyes, although both methods produced more scarring than occurred in the untreated eyes.

Because mechanical denudation involving the limbus has not been a satisfactory experimental lesions in all hands, and because the majority of clinical denudations probably do not involve the limbus, a central lesion 8 mm. in diameter, not involving the limbus, was used in another series of animals. The method was as follows:

A sterilized cork borer, 8 mm. in diameter, was used to produce the outer border of the lesion. The depth to which the cork borer was allowed to penetrate was controlled by a plunger inserted in the cork borer. Care was taken to produce a central lesion which did not involve the limbus. The circumscribed incision having been made with the cork borer, the cornea was stained. A collodion-soaked swab was then rubbed over the epithelium within the circumscribed area, removing this much epithelium. The cornea was again stained, and spots which were not denuded were then removed by means of a corneal knife, so that an area of even staining of equal diameter and of as nearly the same depth as possible, was obtained in all animals. Ether anesthesia was used.

In this series, 42 animals of the same type as those in the previous series were used. The ointments employed were Vanisol,[14] Aquaphor and hydrous wool fat and petrolatum. The sulfonamide compounds used were 10 per cent sodium sulfadiazine in Vanisol, 10 per cent sodium sulfadiazine in hydrous wool fat-petrolatum ointment and 10 per cent sodium sulfacetimide in Vanisol and in hydrous wool fat-petrolatum ointment.

The results are recorded in table 2. The data on the eyes are not presented here in pairs, as they were in table 1. On the fourth day 55 per cent of the untreated eyes, 43 per cent of the eyes treated with ointment base and 21 per cent of the sulfonamide-treated eyes had regenerated. By the fifth day 94, 97 and 71 per cent respectively had regenerated; by the sixth day, 100, 91 and 92 per cent, and by the seventh day, 100, 100 and 100 per cent. Analysis of these statistics by computation of chi square shows on the fourth day (*a*) no significant difference between the untreated eyes and the eyes treated with ointment base, (*b*) no significant difference between the eyes treated with ointment and the sulfonamide-treated eyes and (*c*) a just significant difference between the sulfonamide-treated eyes and the eyes with no therapy at all. The same method of analysis applied on the fifth and sixth days shows that there is, again, a just significant difference between the sulfonamide-treated eyes and the eyes which received no therapy at all, whereas there is no significant difference between the eyes treated with ointment base alone and those treated with sulfonamide compounds.

TABLE 2.—*Influence of Ointments, Powders and Sulfonamide Preparations on Mechanical Denudations Within the Limbus*

	Day of Regeneration							Incidence of Scars
	3d	4th	5th	6th	7th	8th	9th	
Simple denudation...	2	8	7	1	..	..	..	..
Vanisol.....	..	2	7	7	2	..	..	3
Aquaphor.....	1	3	2	..	..	..	..	..
Hydrous wool fat–petrolatum ointment, 50% each.....	2	10	4	2	..	..	..	1
10% sodium sulfacetimide in Vanisol.....	..	..	4	2	..	..	..	..
10% sodium sulfacetimide in hydrous wool fat–petrolatum ointment.....	..	2	3	0	1	..	..	1
10% sodium sulfadiazine in Vanisol.....	..	1	2	2	1	..	..	1
10% sodium sulfadiazine in hydrous wool fat–petrolatum ointment.....	1	1	3	1	..	..	..	..
Totals								Total Eyes Each Group
Denudation alone..	2	8	7	1	0	0	0	18
Ointments alone...	3	15	13	9	2	0	0	42
Sulfonamide compounds.....	1	4	12	5	2	0	0	24

COMMENT ON EXPERIMENTAL DATA CONCERNING USE OF SULFONAMIDE COMPOUNDS IN OINTMENT AND POWDER VEHICLES

It is evident that the sulfonamide preparations in ointment and powder form have some deterring effect on regeneration of corneal epithelium. This is most striking when the type of lesion used for experimental study involves the limbus and is barely evident when the experimental denudation does not involve the limbus. This observation is of practical importance in that the majority of clinical lesions will proba-

14. Vanisol consists of sodium stearate, 20 per cent; cetyl alcohol, 5 per cent; glycerin monostearate, 8 per cent, and water, 67 per cent.

bly be of the central type, in which a barely significant deterring effect is produced on regeneration of corneal epithelium with the use of sulfonamide ointments and powders.

The data show no significant difference in the healing of either type of lesion between the effect of ointment and powder bases and that of sulfonamide-containing ointments and powders. This would indicate that a nonspecific effect of ointments and powders also deters regeneration of corneal epithelium and that the deterring effect noted is not simply a specific effect of the sulfonamide compounds.

To avoid the deterring effect of ointment bases and powders alone, it seemed desirable to determine the influence of the sulfonamide drugs in solutions. The use of a solution would avoid many of the mechanical effects of ointments and powders. However, to maintain adequate levels of the sulfonamide compounds in the cornea with solutions of the drugs, it is necessary to apply the solution frequently.[9] Higher levels in the aqueous and the cornea are obtained with the sodium salts than with the acid preparations of the sulfonamide compounds.[9] For these reasons, 4 drops of 10 per cent sodium sulfadiazine in isotonic solution of sodium chloride was applied to the right eyes of 10 rabbits at 8:30 a. m., 10 a. m., 11:30 a. m., 1 p. m., 3 p. m., 5 p. m., 7 p. m., 9 p. m., 11 p. m. and 12:30 a. m. of each day. The left eyes served as controls and received 4 drops of isotonic solution of sodium chloride alone at the same time intervals. The p_H of the solution of sodium sulfadiazine was approximately 10. The corneas were denuded by the method described by Bellows and Gluckman, tetracaine being used instead of cocaine for local anesthesia. The eyes were stained with fluorescein each day, as in the previous series, and the results are included in table 3.

TABLE 3.—*Influence of 10% Sodium Sulfadiazine on Regeneration of Corneal Epithelium*

	Day of Regeneration				Total No. of Eyes
	3d	4th	5th	6th	
Isotonic solution of sodium chloride	4	5	1	..	10
10% sodium sulfadiazine in isotonic solution of sodium chloride.....	2	6	1	1	10

These results indicate that sodium sulfadiazine did not retard significantly the regeneration of corneal epithelium as compared with isotonic solution of sodium chloride even though the denudations included the limbus. On the fourth day 90 per cent of the eyes treated with isotonic solution of sodium chloride and 80 per cent of the sulfonamide-treated eyes had regenerated. Analysis by computation of chi square on the fourth day failed to show a significant difference.

These studies tend to confirm the work of Bellows and Gluckman,[5] Berens, De Gara and Loutfallah[6] and Smelser and Ozanics[7] in that a sulfonamide compound in ointment or powder form does deter regeneration of corneal epithelium. However, the sulfonamide compounds do not possess this property to a significantly greater extent than do the simple ointment bases and powders used as their vehicles. In the case of lesions which do not involve the limbus, these studies indicate that even the retarding effect of the sulfonamide preparation, as well as that of the ointment and powder base, is just significant and that when a sulfonamide compound in solution is used the retardation is practically nil.

Smelser and Ozanics[7] suggested that sulfadiazine is more desirable than sulfathiazole or sulfacetimide in that it inhibits cell migration less. The results of the present study indicate no significant difference between the sodium salt of sulfadiazine and that of sulfacetimide in this property. For the same reason, these authors stated the opinion that ointment preparations are better than powders. The present study confirms this conclusion. The data collected here, as well as the investigations of Berens, De Gara and Loutfallah[6] and Smelser and Ozanics,[7] indicate that some mechanical factor contributed by the vehicle must be considered and that the chemotherapeutic agent itself is not solely responsible for the retarded regeneration of corneal epithelium when it occurs.

If the influence of the ointment bases alone is considered and the data of table 2 are further analyzed, one finds that Vanisol is significantly more harmful than hydrous wool fat–petrolatum ointment. The 6 eyes treated with Aquaphor are too few to allow statistical evaluation of the effect of this vehicle, but it seems to lie between hydrous wool fat–petrolatum ointment and Vanisol in its retarding action. Smelser and Ozanics[7] found hydrous wool fat to be somewhat less irritating than Aquaphor in rat eyes. Recent studies by Bellows[15] disclosed that the vanishing type of ointment, similar to the Vanisol used here, was a very irritating ointment.

It seems evident from these data that there is little risk of retarding epithelial regeneration in using sulfonamide compounds in ointments, particularly in hydrous wool fat and petrolatum, to prevent secondary infection in epithelial denudations of the cornea which do not involve the limbus. The risk becomes greater when the

15. Bellows, J. G.: Penicillin Therapy in Ocular Infections, Am. J. Ophth. **27**:1206 (Nov.) 1944.

denudations involve the limbus. With the employment of solutions the risk is slight regardless of the extent of the denudation.

CONCLUSIONS

The influence of locally applied sulfonamide compounds in ointment and powder form on regeneration of corneal epithelium varies, depending on whether the lesion does or does not involve the limbus.

Ointment bases and powder bases alone and sulfonamide-containing ointments and powders deter regeneration of corneal epithelium to a greater degree in denudations involving the limbus than in denudations within the limbus.

Little significant difference was found between the effect of the ointment bases and powder bases alone and the sulfonamide-containing ointments and powders on the rate of regeneration of corneal epithelium.

A 10 per cent solution of sodium sulfadiazine had little or no deterring effect even on denudations involving the limbus. It is evident, therefore, that the major deterring action of sulfonamide compounds on regeneration of corneal epithelium must be due to some mechanical effect of the vehicle. We cannot speculate as to what this factor is on the basis of this study.

Scarring of the cornea was more frequent in the treated denudations than in the untreated ones, but there was no difference in the incidence of scarring between the eyes treated with sulfonamide ointments and powders and those treated with ointments and powders alone.

Smith, Kline and French Laboratories supplied the microcrystalline sulfadiazine; Wallace and Tiernan Products, Inc., the buffered sulfanilamide, and the Schering Corporation, the sodium sulfacetimide.

Hospital of the University of Pennsylvania.

CHOROIDEREMIA

REPORT OF A CASE

H. MAGDER, M.D.
MONTREAL, CANADA

Choroideremia has been defined as a condition in which the choroid and the pigment layer of the retina eventually disappear. The disease is bilateral, the periphery of the fundus becoming involved early in the process and the macula late. Thus, the first symptoms are usually night blindness and loss in the field of vision.

The condition was first described by Mauthner in 1871, and 28 cases have been reported in the literature to date. The following case is that of a patient first seen at the eye clinic, Queens General Hospital, on May 19, 1944.

REPORT OF CASE

History.—W. W., a white man aged 58, complained that he could not see at night and that because of this he always had to be home before dark. He had been employed as a janitor for fifteen years. About ten years ago, at which time he was working only at night, he began to notice that he had difficulty in seeing at night. This difficulty became progressively worse, so that three years prior to consultation he asked to be transferred to day work.

Past History.—About 1924 he had difficulty with his eyes. His memory is not very clear about this episode, but he recalled that his vision was blurred and that he suffered from photophobia. At that time he was admitted to the Brooklyn Eye and Ear Hospital, where he was treated with drops. As a result of roentgenographic examination, all his teeth were extracted. He made a complete recovery. (I wrote for a report, but no records of his case were available.)

Family History.—His father died at the age of 70. He had worked as a night watchman until two years before he died. His mother died when she was 69. Her vision was good. Three brothers and one sister are dead, and there are two living sisters, none of whom had ever had symptoms of night blindness. There were four living children. The oldest was 33 and was in the Army of the United States overseas. The other children were 14 years, 3 years, and 19 months of age. Examination, with the use of a mydriatic, revealed that the fundi were normal. There was no history of consanguinity of the parents or of the grandparents.

There was no evidence of a functional disorder.

Physical Examination.—The patient was well developed and physically and mentally active. His blood pressure was 154 systolic and 86 diastolic. The only abnormality was cloudiness of the left antrum and the right ethmoid cells, as noted in roentgenograms.

Laboratory Report.—The Wassermann reaction was negative. The blood sugar measured 95 mg. per hundred cubic centimeters. Urinalysis revealed nothing abnormal. The blood cell count, including the differential count, was normal.

Examination of the Eyes.—Visual Acuity: Vision was 20/70 in each eye without correction. It was 20/20 in the right eye with a correction of — 1.75 D. cyl., axis 85 and 20/30 in the left eye with a correction of — 0.50 D. sph. ⊃ — 1.00 D. cyl., axis 95.

External Examination: The lids of both eyes were normal. The conjunctivas were clear. The corneas were clear except for arcus senilis. The anterior chambers were clear. The irises were of normal appearance. The pupils were equal and regular and reacted well in accommodation but responded sluggishly to light. The lenses were normal.

Study of the Fundi: Examination of the right fundus revealed a peculiar greenish white reflex except at the disk, the macula and the extreme periphery of the fundus. The margins of the disks were slightly indistinct, but the disk markings were normal, with no signs of atrophy. The blood vessels were generally attenuated, branched normally and showed no signs of sclerotic changes.

In the macular area there was a collection of pigment, of about ¼ disk diameter, which rested on a background giving a pink reflex, of about 1 disk diameter.

Except for the macular area and the extreme periphery, the choroid appeared to be completely absent. The blood vessels stood out sharply against the greenish white background, and in the macular area they appeared to be in two layers—one superficial and the other deep. Scattered throughout the fundus were a few small collections of pigment. These did not have the appearance of the pigment seen in cases of retinitis pigmentosa.

In the extreme periphery choroidal vessels and pigment were seen. This area formed a complete ring but seemed slightly wider temporally.

The left fundus showed essentially the same picture as the right.

Slit Lamp Examination: No changes were noted in the anterior segment of the eye. A careful study of the anterior portion of the vitreous failed to show collections of pigment, as noted by one observer (Scobee[1]).

From the service of Dr. Guernsey Frey, Department of Ophthalmology, Queens General Hospital, Jamaica, N. Y.

1. Scobee, R. G.: Choroideremia, Am. J. Ophth. **26:** 1135-1143 (Nov.) 1943.

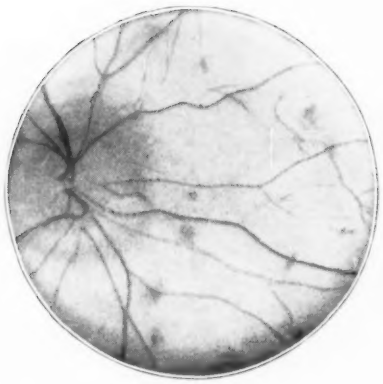


Fig. 1.—Photograph showing the disk and the nasal retina of the right eye.

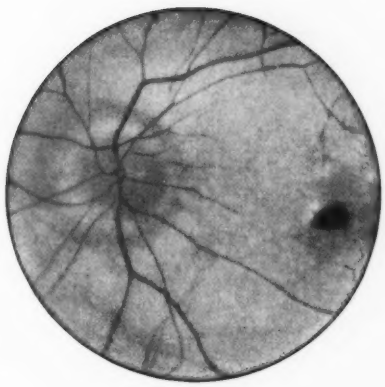


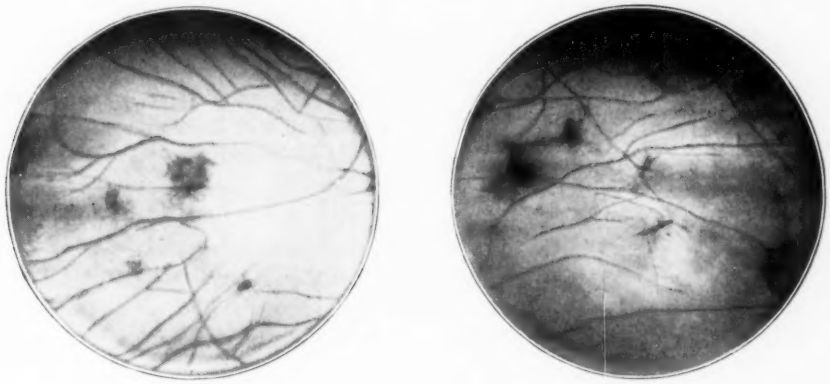
Fig. 2.—Photograph showing the disk and the macular area of the left eye.

Study of the Visual Fields: There was a central visual area of from 5 to 10 degrees about the fixation point of each eye. With a 17 mm. white test object at 330 mm. a narrow peripheral field was obtained, which formed a complete ring except for the upper part of the field. The fields were almost identical in the two eyes (fig. 4).

COMMENT

In her textbook "Developmental Abnormalities of the Eye," Mann [2] suggested that choroideremia is caused either by (*a*) failure of the ciliary arteries to bud at the 16 mm. stage or by (*b*) failure of the outer layer of the optic cup to produce pigment (at the 10 mm. stage), with the result that the stimulus for the capillary growth may fail, even though the arteries do bud. She expressed the opinion that choroideremia is a developmental condition but admitted that its origin is not fully understood, owing to its rarity, the failure to observe cases early and the absence of material for microscopic examination.

In 1937, Bedell [3] made a complete review of the literature and, in addition, reported several cases that he had observed personally. He stated the belief that the condition is a postnatal pathologic dissolution of the choroid. Other cases have been reported by Friedman (1940),[4] Shapira and Sitney (1943)[5] and Scobee (1943).[1] Scobee reported 2 cases, in brothers. He was able to follow his patients and show by examinations of the fundus and studies of the visual fields definite progress of the pathologic condition over a relatively short time. His observa-



A B

Fig. 3.—Photographs showing the periphery of the fundus, with pigment, of the right (*A*) and of the left (*B*) eye.

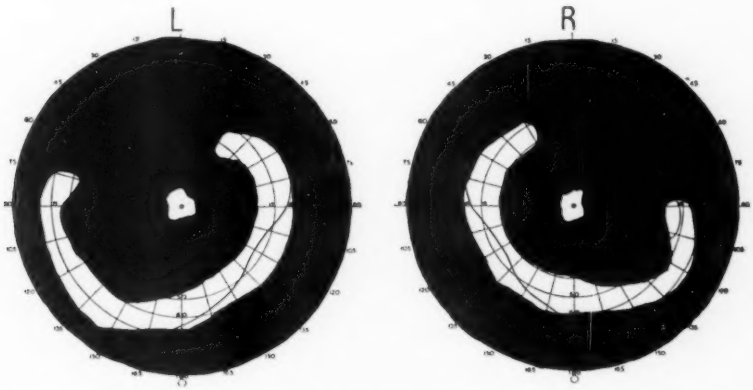


Fig. 4.—Visual fields obtained with a 17 mm. white test object at 330 mm. In the left eye vision was corrected from 20/70 to 20/30 and in the right, from 20/70 to 20/20.

2. Mann, I.: Developmental Abnormalities of the Eye, New York, The Macmillan Company, 1937.

3. Bedell, A. J.: Choroideremia, Arch. Ophth. **17**: 444-467 (March) 1937.

4. Friedman, B.: Choroideremia, Arch. Ophth. **23**: 1285-1287 (June) 1940.

5. Shapira, T. M., and Sitney, J. A.: Choroideremia, Am. J. Ophth. **26**:182-183 (Feb.) 1943.

tions and those in the case reported here tend to confirm the opinion that the pathologic process is postnatal rather than congenital.

Verhoeff [6] expressed the opinion that many cases of supposed choroideremia are actually instances of retinitis pigmentosa in which the choroid is hidden by widespread gliosis of the degenerated neuroepithelium. The many persons who observed the case reported here stated the belief that it was a case of true choroideremia, and not one of gliosis.

SUMMARY

A case of choroideremia was observed in a man 58 years old. The patient had only slight myopia, whereas most of the patients reported on with this condition have shown a moderate or a high degree of myopia. The disease progressed over a period of ten years, so that a change from night to day work was necessary three years ago. The fundus and the defects of the visual fields were practically identical in the two eyes. Acuity in the central visual fields remained excellent despite the advanced stage of the disease.

Photographs of the fundus were made by Marfang of the Institute of Ophthalmology, Presbyterian Hospital, New York.

1526 Crescent Street.

6. Verhoeff, F. H.: Retinitis Pigmentosa with Widespread Gliosis—So-Called Choroideremia, Arch. Ophth. **27**:688-691 (April) 1942.

PARINAUD'S OCULOGLANDULAR SYNDROME DUE TO A YEASTLIKE ORGANISM

MAJOR FREDERICK H. THEODORE
MEDICAL CORPS, ARMY OF THE UNITED STATES

At the present time it is well established that what was first known as Parinaud's conjunctivitis, after its description by that author in 1889, is not a definite disease with specific pathologic and bacteriologic characteristics, but is in reality a symptom complex which can be caused by a number of etiologic factors. For that reason the term "Parinaud's oculoglandular syndrome," [1] for a chronic uniocular granulomatous conjunctivitis with regional lymphadenitis, appears most appropriate. Tularemia, tuberculosis, an unidentified virus infection, lymphogranuloma venereum, syphilis and even infections with the hemolytic staphylococcus and Bacillus proteus,[2] have been listed as causes of the condition. But by far the most common agent appears to be the leptothrix, first found in pathologic sections by Verhoeff, in 1913 [3] and later obtained in cultures of conjunctival material by Verhoeff and King, in 1933.[4] Others have confirmed these observations and have also demonstrated the organism in the preauricular gland.[5] While in still other cases of the syndrome no etiologic agent has been discovered, it is likely, as Duke-Elder [6] stated, that as more cases are studied still other causes will be brought to light.

It is the purpose of this paper to report another case of Parinaud's oculoglandular syndrome in which the condition was rather severe and appears to have been due to infection with an unidentified yeastlike body, and to suggest an additional cause for the condition.

REPORT OF A CASE

Lieut. C. T., aged 30, was first seen at the eye clinic of the Miami Beach Training Base on June 24, 1943. About ten days previously his right eye had become inflamed, and a few days later the right preauricular gland had begun to enlarge. His past history was essentially noncontributory.

Examination of the right eye at this time revealed the vision to be 20/20. There were considerable edema and pseudoptosis of the right upper lid, due to severe conjunctivitis, which involved only the upper lid and the fornix. On the injected and edematous conjunctiva were a number of rounded, raised, yellowish gray nodules, varying in diameter from 0.5 to 4 mm. These were mainly situated at the upper tarsal border. Although superficial, they were not ulcerated. The eye itself, as well as the conjunctiva of the lower lid, was normal and remained so during the entire course of the disease. The right preauricular gland was swollen and tender.

The left eye was entirely normal in all respects.

General physical examination revealed nothing abnormal.

The diagnosis of Parinaud's oculoglandular syndrome was made, and investigations as to the exact cause were begun. The results of laboratory examinations are noted later.

The condition progressed, and in the course of a week the conjunctival nodules increased in both size and number. The preauricular gland increased to the size of a plum, and two almond-sized nodules appeared on the right side of the neck. The patient was admitted to unit 1 of the station hospital on July 3, and the largest nodule was removed for biopsy. Several smaller nodules were taken on July 7.

For the first five days after his admission the patient was rather ill; his temperature rose to 101.4 F., and he complained of considerable pain in the enlarged glands. Thereafter he was entirely afebrile.

On his admission administration of sulfadiazine was begun, but was discontinued after several days because of nausea. In place potassium iodide was given, but use of this drug, too, had to be stopped because of the development of a pustular eruption.

By July 14 the conjunctival infiltrates had disappeared and the eye had assumed a normal appearance. The glands, however, continued to be painful, swollen and tender. Roentgen therapy was instituted and resulted in softening and suppuration. The preauricular gland was drained surgically on July 24, and about 15 cc. of pus was obtained. Bacteriologic studies of

1. Duke-Elder, W. S.: Text-Book of Ophthalmology, St. Louis, C. V. Mosby Company, 1938, vol. 2, p. 1629.

2. Zuccoli, A.: Ueber Proteus-Conjunctivitis zugleich ein Beitrag zur Kenntnis des sogenannten Parinaudschen Syndroms, Schweiz. med. Wchnschr. **18**:803 (Aug. 21) 1937.

3. Verhoeff, F. H.: Parinaud's Conjunctivitis: A Mycotic Disease Due to a Hitherto Undescribed Filamentous Organism, Arch. Ophth. **42**:345, 1913.

4. Verhoeff, F. H., and King, M. J.: Leptotrichosis Conjunctivae (Parinaud's Conjunctivitis): Artificial Cultivation of the Leptotriches in Three of Four Cases, Arch. Ophth. **9**:701 (May) 1933.

5. Wright, R. E.: Isolation of Verhoeff's Leptothrix in a Case of Parinaud's Syndrome, Arch. Ophth. **18**:233 (Aug.) 1937.

6. Duke-Elder,[1] p. 1630.

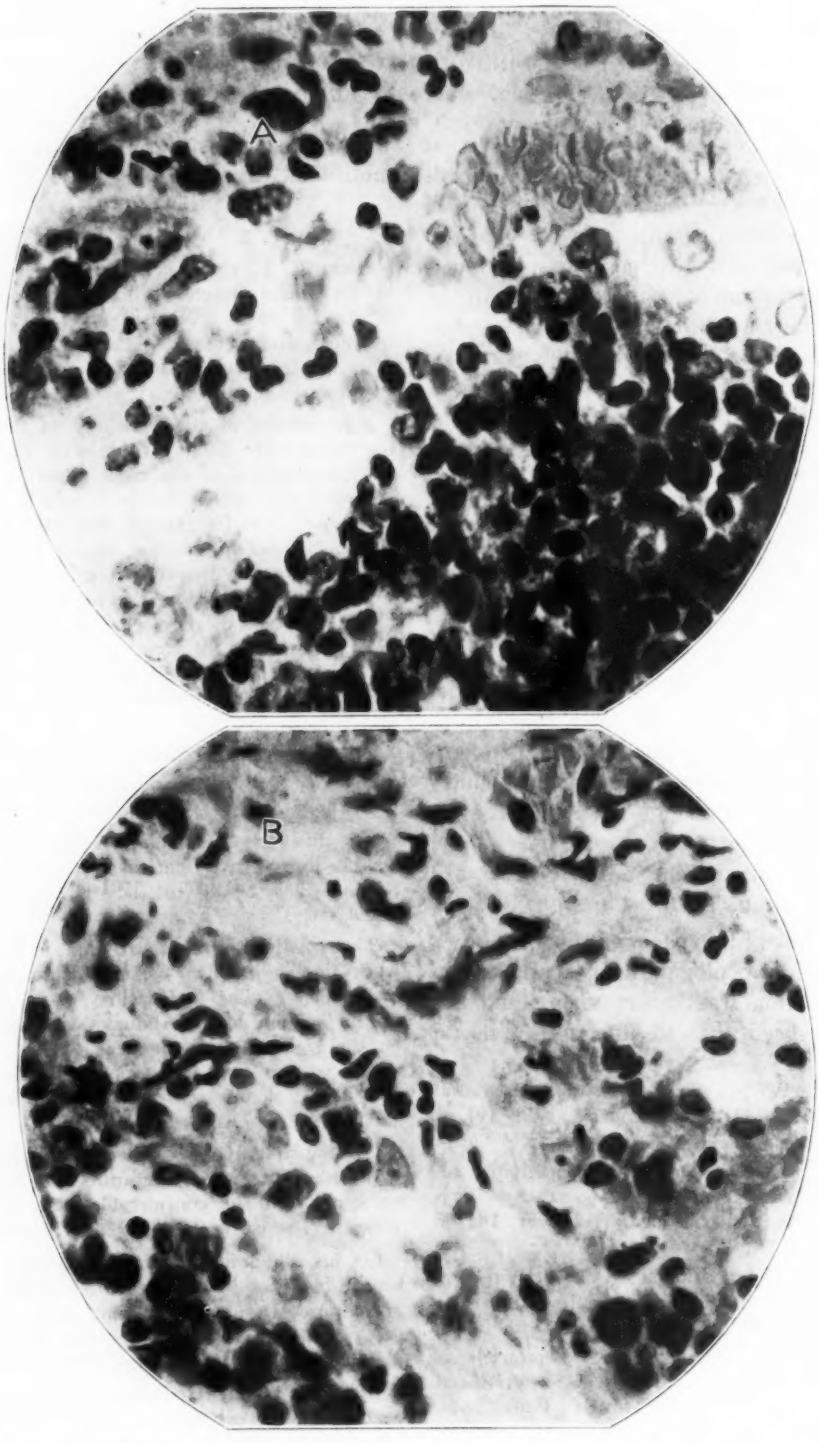


Fig. 1.—Photomicrographs of biopsy specimens from the conjunctiva, showing (*A*) scattered yeastlike bodies, and (*B*) a number of yeastlike bodies. In the center (*B*) one of these bodies, having an hourglass shape, appears to be budding. Magnification, 2,175.

the pus, reported later, gave significant results. On August 19 the larger of the two glands in the neck was incised and from this also pus was obtained. It required two months for the first incision to heal; thereafter the area involved remained indurated, and the tissue reaction in general suggested an unusual type of infection. Nine months after the incision of the cervical gland the wound in the neck was still draining to a slight extent.

Laboratory Examinations.—Smears, epithelial scrapings and cultures of secretions from the conjunctiva, with the use of special mediums, were all negative for pathogens. However, examination of the material obtained from the conjunctiva revealed a yeastlike body. A similar yeastlike body was found in the pus from the preauricular gland. This was considered the etiologic agent.

The biopsy specimens, both the material fixed in formaldehyde and that fixed in Zenker's solution, were variously prepared with hematoxylin and eosin, Giemsa's stain, the Ziehl-Neelsen method and the Verhoeff modification [7] of the Gram stain, which was used to demonstrate the leptothrix. The best results were obtained with hematoxylin and eosin and the Verhoeff stain. The sections showed that the conjunctival nodule was composed essentially of granulation tissue, with masses of lymphocytes, plasma cells and many fibroblasts in various stages of development, as well as new-formed blood vessels. The nodule was ulcerated at the surface; the surrounding tissue showed evidence of necrobiosis (poor staining, pyknosis and distortion of cells). A number of polymorphonuclear leukocytes occurred in this region but were not found to any extent deeper in the section. Numerous phagocytes containing granules taking a deep blue stain were noted. Rare giant cells were seen. Throughout the section, especially in the more superficial portion, round or oval objects, slightly larger than an erythrocyte, lay scattered about. These objects took a uniform deep blue, almost black, stain, with no central paler portion (fig. 1 *A*). Some of them seemed to have a single or double refractile ring, or halo, about them. A number appeared to be budding. Several had an hourglass shape (fig. 1 *B*), while others seemed to have small satellites around them. The objects just described appeared quite different from the lymphocytes present; in the more necrotic zone they retained their characteristics to a much greater extent than the cellular elements and thus stood out readily. It was felt that these objects fulfilled most of the morphologic requirements of yeasts and beyond doubt could be considered as such. No leptotriches were found.

Bacteriologic examination of the pus obtained from the preauricular gland revealed similar yeastlike bodies on direct smears stained with the Gram method (fig. 2 *A* and *B*). On culture an unidentified yeast was grown but, unfortunately, was discarded, as it was erroneously thought to be a contaminant. Studies of the pus obtained from the cervical gland showed no organisms of any kind.

The slides were reviewed by Lieut. Col. Phillips Thygeson. He saw the bodies described and felt that they were probably the causative agent. He advised, however, inasmuch as positive cultural evidence was lacking, that the case be reported as one in which the condition was due to a yeastlike organism. He, too, found no leptotriches. This opinion was later concurred in by Major James H. Allen. Dr. Alson E. Braley [8] also thought that the bodies could be yeasts.

The usual laboratory tests, such as the blood count, urinalysis and Kahn test of the blood, gave normal results. Agglutination tests for tularemia gave negative results on three occasions, as did tests for undulant fever and heterophile antibodies. The Frei and Mautoux tests likewise gave negative results.

COMMENT

In the case of Parinaud's oculoglandular syndrome described here a yeastlike body was found both in biopsy specimens from the conjunctiva and in smears of pus aspirated from the preauricular gland. It is believed that an unidentified yeastlike organism was the cause of the condition. This opinion was concurred in by several authorities in the field of ophthalmic bacteriology.

There can be little doubt that the case falls into the broad group of conditions known as Parinaud's oculoglandular syndrome. The conjunctival lesions, the glandular involvement, the clinical course, the prompt cure of the conjunctivitis after excision of the involved portions, all follow the usual description of this syndrome. The only unusual feature is the glandular suppuration and induration, with extremely slow healing. This points to an unusual etiologic factor and is entirely consistent with the characteristics of a yeast infection.

Glandular suppuration is rare in cases of Parinaud's oculoglandular syndrome. Verhoeff [9] did not observe it in his cases of the syndrome due to the leptothrix. McKee,[10] in emphasizing the rarity of suppurative glands, mentioned 2 exceptions, notably 1 of Parinaud's original cases, reported in 1889, and cases reported by Gifford, in 1898, in which suppuration was frequent. These early cases were not as completely studied as later ones and not much can be stated about the etiologic factors. It appears, therefore, that glandular suppuration is not present in the type of Parinaud's oculoglandular syndrome designated by Verhoeff as "leptotrichosis conjunctivae," while in other types it may occur.

7. Verhoeff, F. H.: Improved Method of Staining Within Tissues Leptotriches of Parinaud's Conjunctivitis and Gram-Positive Micro-Organisms, J. A. M. A. **115**:1546 (Nov. 2) 1940.

8. Dr. Braley and Mr. A. Marfang, of the Institute of Ophthalmology, Presbyterian Hospital, New York, made the photomicrographs.

9. Verhoeff, F. H.: Observations on Parinaud's Conjunctivitis (Leptotrichosis Conjunctivae), Am. J. Ophth. **1**:705 (Oct.) 1918.

10. McKee, S. H.: Parinaud's Conjunctivitis with Suppuration in the Pre-Auricular, Sub-Maxillary and Supra-Clavicular Glands, Tr. Am. Ophth. Soc. **25**:236, 1927.

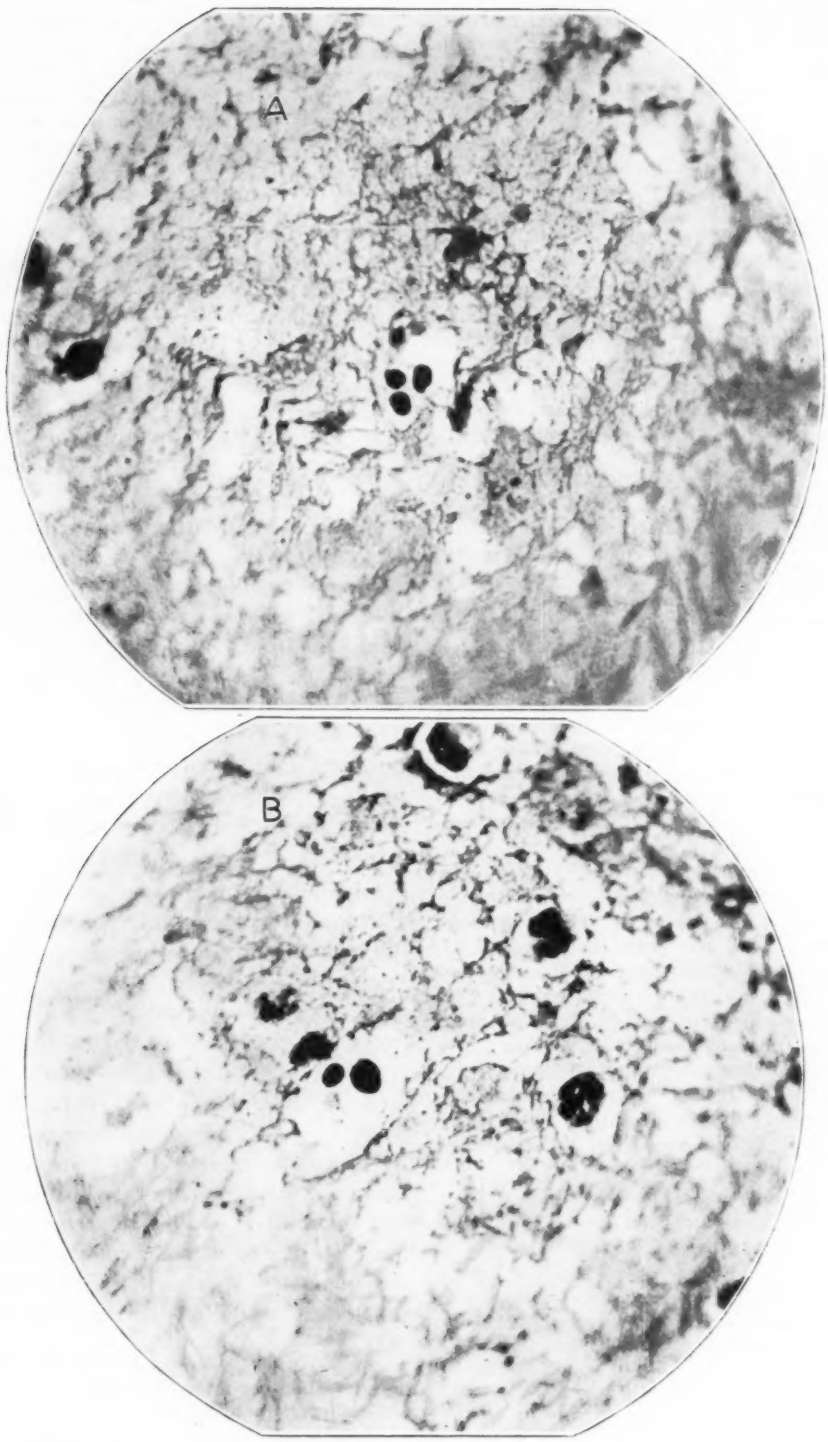


Fig. 2.—Gram stain of pus from the preauricular gland, showing (*A*) group of three yeastlike bodies and (*B*) other yeastlike bodies. Magnification, 2,175.

In the case described in this paper the leptothrix was carefully searched for, without success, by all who studied the slides. Furthermore, the histologic picture did not conform to that present in the cases in which the condition was due to the leptothrix.

In conclusion, in my opinion Duke-Elder's concept that Parinaud's oculoglandular syndrome is a complex of symptoms that may result from infection with any one of a number of known or unknown agents is the most tenable one, in the light of present knowledge. It is thought that in this paper a new cause has been demonstrated, an organism resembling a yeast, which, unfortunately, could not be further classified.

SUMMARY

The case of Parinaud's oculoglandular syndrome reported here was unique in that, while the ocular condition cleared in a few weeks, regional glandular suppuration occurred, requiring surgical drainage, and ultimate healing was prolonged. Both biopsy material from the involved conjunctiva and smears of pus aspirated from the preauricular gland revealed an organism resembling a yeast. In view of the clinical course and the laboratory findings, it is believed that this yeastlike organism was responsible for the disease.

1120 Park Avenue, New York (26).

MANAGEMENT OF PARALYSIS OF DIVERGENCE

SAMUEL KAMELLIN, M.D.
CHICAGO

A number of papers have been written on the etiology,[1] physiology and pathology of paralysis of divergence, and various treatments have been devised; therefore, there is no need to go into these phases of the subject now.

Divergence and its antagonist, convergence, are essential in the maintenance of fusion. By divergence [1b] is meant the ability of the visual axis of both eyes when converged on near objects to separate in order to sight on an object more remote.

The findings in cases of paralysis of divergence are as follows: [2]

1. There is diplopia in the midplane for distant vision.

2. The diplopia is equal in all directions of gaze at the same distance from the subject's eyes.

3. The diplopia is eliminated as the eyes converge to near distances, varying from 2 to 10 feet (60 cm. to 3 meters), and then binocular vision is obtained.

4. The images are homonymous and separate farther as the test object is farther withdrawn from the subject.

Many etiologic factors have been suggested, and they are as varied as the number is great. There are several conditions from which paralysis of divergence must be differentiated and which have been adequately discussed before; therefore, they need not be considered here. The purpose of this paper is to report 2 cases in which operation was performed by the late Dr. Sanford R. Gifford. However, there were others in which use of small amounts of prism made operation unnecessary and therefore which are not reported here. Bruce [1b] stated that resection or advancement of one or both rectus muscles is the logical procedure. Stokes [1a] mentioned the operations described by Theobald in 1886, by Uthoff in 1893 and by Sachs in 1898. These operations were tenotomy of one internal rectus muscle, tenotomy of both internal rectus muscles and advancement of the external rectus muscle. Stokes stated that it would seem more rational to perform an advancement or a resection of both external rectus muscles in cases in which the paralysis is stationary.

Gifford felt that shortening of one or both external rectus muscles by the O'Connor cinch method was the safest surgical procedure because if an overcorrection is obtained one or more cinch sutures can be removed as soon as the overcorrection is noted. On the other hand, if an insufficient amount of paralysis has been corrected, the residual divergence can be corrected by use of the same technic on the external rectus muscle of the fellow eye. I have been unable to find any mention of the use of the O'Connor cinch operation for correction of this condition, although the operation is employed in many parts of the country for various other muscular anomalies.

REPORTS OF CASES

CASE 1.—J. M., a medical student aged 22, was seen in the eye clinic on Feb. 19, 1941, complaining of diplopia for distance, first noticed about two years previous to this date. This difficulty had become increasingly worse until the time of his first examination. He also complained of a dull headache at this time.

Examination revealed mild folliculosis of the conjunctiva of the lower lid. The cornea, sclera, iris, anterior chamber, lens and pupillary reflexes were normal. With a correction of + 0.25 D. sph., axis 90 for each eye vision was 20/13. In the cover test a 10 D. prism base out for distance, at 20 feet (6 meters), and a 4 D. prism base out for near vision were necessary to overcome the diplopia.

He was seen again on March 8, 1941, and examination showed that the diplopia increased as greater distance was obtained between the observer and the test object and was equal in all fields of vision. The diagnosis of paralysis of divergence was made, and an O'Connor cinch operation on one or both external rectus muscles was advised. An eight strand cinch suture operation was performed on the left external rectus muscle on June 13, 1941, at Passavant Hospital. The sutures were removed on June 26, at which time his eyes were straight for near and distant vision. The diplopia was relieved, but he still complained of frontal headache, which was not affected by reading and which came on shortly after arising in the morning. He was followed in the clinic at intervals until his graduation from medical school and was last seen on Dec. 16,

From the Department of Ophthalmology, Northwestern University Medical School.

1. (*a*) Stokes, W. H.: Paralysis of Divergence, Arch. Ophth. **11**:651-664 (April) 1934. (*b*) Bruce, G. M.: Ocular Divergence: Its Physiology and Pathology, ibid. **13**:639-660 (April) 1935.

2. Gifford, S. R.: Textbook of Ophthalmology, Philadelphia, W. B. Saunders Company, 1941. Stokes.[1a]

1943, at which time he had no recurrence of diplopia. He still had headaches, not related to the use of his eyes, and his measurements with Maddox rods were 3 prism diopters of esophoria for distance, 1 prism diopter of esophoria for near vision and no vertical deviation.

CASE 2.—Mr. C. G., aged 34, was seen by Dr. Sanford Gifford on Nov. 11, 1943, complaining of diplopia for distance, dating back as far as he could remember. The degree of diplopia was constant. He was wearing a correction of — 0.50 D. sph. with a 4.5 D. prism base out for the right eye (vision 20/15) and —0.50 D. sph. with a 5.5 D. prism base out for the left eye (vision 20/20). The lids, conjunctiva, cornea, sclera, iris, anterior chamber, lens and fundus were normal. In the cover test he had esophoria for near and for distant vision. Without his glasses the diplopia was corrected by a 13 D prism base out for distance. He had diplopia beyond 11 inches (33 cm.) but none closer. His near point of convergence was 3 minutes. The diplopia increased as the test light was drawn farther away from the subject and was equal in all directions. The Maddox rod showed 12 prism diopters base out for distance and no lateral deviation for near vision. A diagnosis of paralysis of divergence was made, and an O'Connor cinch operation on the left external rectus muscle was advised.

The patient was admitted to Passavant Hospital and an eight strand cinch suture operation was performed on the left external rectus muscle on Jan. 8, 1944. He was seen again on Jan. 27, 1944, and the cover test showed that his eyes were straight for both near and distant vision. He was able to converge to 8 inches, and the Maddox rod test revealed 6 prism diopters of exophoria for distance and 4 prism diopters of esophoria for near vision. The diplopia was entirely relieved, and the cinch sutures were removed. He has been free from symptoms and has had no complaints since the operative procedure.

MANAGEMENT OF PARALYSIS OF DIVERGENCE

Dr. Gifford managed cases of paralysis of divergence in the following way:

1. Patients needing a small amount of prism base out to superimpose images at distance were given correction for distance, or simple prism lenses base out were prescribed if no correction for distance was needed.

2. Patients needing a larger amount of prism base out for correction of diplopia at distance were advised to have an O'Connor cinch operation on one or both external rectus muscles, depending on the amount of prism necessary to superimpose the images at distance. It is estimated that each strand of the cinch suture will correct approximately 1½ prism diopters of deviation when the operation is performed on the lateral rectus muscle with nothing done to the opposing muscles.

The views expressed in this paper concerning the type of operation to be performed in cases of paralysis of divergence are those of the late Dr. Sanford R. Gifford, at whose suggestion I wrote this report.

Northwestern University Medical School.

VISUAL EXERCISES IN OPHTHALMOLOGY

JOSEPH I. PASCAL, M.D.
NEW YORK

The subject matter of this paper pertains to work which, I think, will form a larger portion of ophthalmologic practice in the future than it does at present. I am using the term visual exercises in its widest possible application.

All are familiar with exercises which are used to develop and improve central macular vision. I think it is generally agreed that these exercises do not increase macular acuity in the physiologic sense. The improvement in vision which results in a great many cases is most likely due to an intensification of the psychic phase of the act of seeing. As Dr. Lancaster [1] has so aptly put it in a recent article, "seeing is only half ocular—the other half is cerebral."

The improvement of central vision is often a large part of the orthoptic treatment of squint. The dulled central vision of the deviating eye is called amblyopia ex anopsia, which term immediately suggests that the cause of the poor vision lies in failure to use the eye. It is the mind which fails to function, for the amblyopic eye has been open all the time and has received the same retinal images as the other eye. The remedy of course is to force the patient to apply his mind to the images in the deviating eye and to use this eye as far as possible for critical, detail vision.

There are numerous ways of exercising the amblyopic eye, and every practitioner usually adds some of his own design. The mental aspect is all important, and these exercises, as far as possible, must be interesting to the patient. They must create a pleasurable mental tone; such an exercise is watching an interesting moving picture with the amblyopic eye.

In general, there are two or three principles which govern the multitudinous exercises of this type. One is to introduce into the exercises a good deal of motion, making the seeing process dynamic. This is accomplished, for example, by watching a rotating target or a swinging light. Another is to introduce a variety of colored patterns, such as the old-fashioned kaleidoscope provided. Still another is to associate the act of seeing with some activity of the body, some motor expression, usually of the hands. But other exercises, such as motor activities of the organs of speech or a motor reaction of the legs, may be included. Still other examples are stringing colored beads or sticking colored pins into selected letters, as a sort of game.

Now what has happened in cases of amblyopia when, for example, initial vision with the best correction is 20/100 and after a period of exercises the vision improves to 20/30 or 20/20? The retinal images of the letters on the 20 foot (6 meter) line at the end of the training period are not focused any better than they were at the beginning, nor are they different in size, shape or form. Why are they legible now when before they merely registered as indistinct blotches? The answer is simply that the mind has been trained to interpret the former retinal "blotch." The improvement in vision is due entirely to a better response in the psychologic phase of seeing.

This is indeed a remarkable phenomenon, but no stranger than what one frequently encounters in everyday life. A smudge on the horizon over the sea which to the landlubber may be a cloud, or what not, is at once recognized by the experienced seaman as a vessel. The retinal images in the eyes of the two observers may be exactly the same in clarity, size and shape, but the mental contribution to this retinal image is vastly different. With visual exercises better use of the amblyopic eye has been accomplished for the letters or figures on the Snellen chart and, by extension, for all familiar objects.

From these considerations the thought irresistibly forces itself on the mind: Why cannot this process be extended? If the psychic contribution to vision can be so greatly enlarged in these cases after the correction of the ametropia, why can it not be developed, to some extent at least, without the correction of the ametropia. To be sure, in the uncorrected amblyopias one is dealing with a nonfocused retinal image, as against a focused retinal image in the corrected amblyopias.

Presented before the New York Society for Clinical Ophthalmology, Jan. 8, 1945.

1. Lancaster, W. B.: Present Status of Eye Exercises for Improvement of Visual Function, Arch. Ophth. **32**: 167 (Sept.) 1944.

But the mind registered the focused retinal image only as an indistinct retinal blotch before it was trained to respond to this blotch in terms of definite form perception. Why cannot the mind be trained to respond likewise to an unfocused retinal blotch? The response to such an image may not be so pronounced, but there seems to be no reason that significant improvement cannot be developed. The fact is that this can be done and has been done.

I know that in saying this I am treading on unorthodox territory, and it is true that this field has been exploited, perhaps overexploited, by some licensed and unlicensed practitioners. But this does not vitiate whatever is sound in the procedure.

When Huxley's book "The Art of Seeing" [2] came out, the author and his book were severely criticized by leading authorities in ophthalmology. It was therefore with a good deal of temerity that I ventured to write in defense of the author and the system loosely called the Bates system.[3] One can imagine my relief on seeing the article on this subject by Dr. Lancaster in the ARCHIVES. This article should be read and reread until one becomes thoroughly familiar with this broad viewpoint toward visual exercises.

Not only central vision but peripheral vision can be improved with training and exercise. Dr. Frank M. Low, of the School of Medicine of the University of North Carolina, has done some interesting work along this line. He has shown that peripheral visual acuity is independent of central acuity and, like the latter, can be improved with training. Exercises to improve peripheral vision may not be necessary for the average person. But improved peripheral vision is certainly a great help in many lines of endeavor, aside from aviation. Many a poor or accident-prone driver may owe his difficulties to inefficient peripheral vision. And many a worker in an industrial plant may have a greater margin of safety from accidents by developing more efficient peripheral vision. Incidentally, the fact that peripheral vision improves with training may have a bearing on testing of the visual fields when such tests are made repeatedly, as in cases of glaucoma and other conditions.

There has been quite a stir recently regarding claims for the cure of color blindness by means of visual exercises. The reports have aroused a good deal of controversy, some rather acrimonious. The facts as far as they were ascertained, however, did show that a number of men who were rejected by the Army, Navy and Air Forces because of color blindness passed the required tests after the training. The conservative view of this process taken by *The Journal of the American Medical Association* was that the exercises did not "cure" the color blindness, but merely "educated" the candidate or trained him in some way for better color perception.

Probably the use of the word "cure" is not appropriate in the claims for treatments which tend to improve color discrimination. Although it may be quibbling about terms, one may ask whether one really "cures" disease or whether one merely provides favorable conditions for the inherent recuperative powers of the body and mind to assert themselves? However, whether these men were "cured" or "educated," they could distinguish the colored patterns on the Ishihara or similar plates after a series of exercises, something which they could not do before the training. And the skill to distinguish the colored patterns on the plates certainly was carried over to other objects and colored configurations. It is no exaggeration to say that these persons have acquired a greater degree of color perception and color discrimination than they had before taking the exercises.

Now what is the mechanism by which these persons acquired their increased capacity for color perception? It is not known exactly. Certainly no new structural elements were developed in the retina, nor were any new visual pigments formed. It was probably purely an educational process, teaching the mind to recognize certain visual stimuli in terms of color. Not much is known about the process of color rehabilitation, but how much is really known of the mechanism of color vision in the normal person?

There are many theories of color vision. Psychologists swear by the Hering and Ladd-Franklin theories; physicists swear by the Young-Helmholtz theory, and physiologists, taking an over-all view, swear at all of them. Some recent work on color vision suggests that color perception is not an all-or-none phenomenon. There may be a gradation in color vision, corresponding somewhat to the gradation in form vision. Form vision ranges from a maximum of 20/15 or 20/10 to a minimum of 20/200 or less. Probably color vision likewise ranges from a high level embracing the capacity to distinguish a great many colors, shades and tints to total

2. Huxley, A. L.: The Art of Seeing, New York, Harper & Bros., 1942.

3. Pascal, J. I.: On Aldous Huxley's "The Art of Seeing," Am. J. Ophth. **26**:636 (June) 1943.

deficiency in color vision. Between these are the color amblyopias of varying degree, corresponding to the form amblyopias of varying degree. Just as one can in many cases remove or improve a form amblyopia, so one may be able to improve a color amblyopia. This, I believe, is a justifiable open-minded attitude.

A type of visual exercise which is practiced more by teachers and educators generally than by ophthalmologists concerns improvement in the speed of reading. There are several instruments designed specifically for this purpose. But even without elaborate instruments one can teach patients, to some extent at least, the art of rapid reading. Many a student who had unwittingly acquired a habit of reading slowly, say, 200 words a minute, can, by being prodded and urged and by making an effort, increase his speed to 300 or more words a minute. In these days, when every intelligent student and adult has far more reading than he can ever hope to do, the acquisition of skill in rapid reading is certainly a worth while accomplishment.

Akin to this type of visual exercise, but much more developed and on a broader psychologic basis, is the work being done now at Ohio State University by Dr. Samuel Renshaw and his associates. Primarily, their training is to increase the speed and span of the visual act. Exercises for this purpose have been used and found effective by some branches of the armed services. But rapid and extensive visual recognition is certainly a worth while skill in many lines of civilian endeavor. The work of Dr. Renshaw has shown to what an amazing extent this faculty can be developed by proper training. Incidentally, this work has wider implications than those I have mentioned. Ramifications of it reach, though by a different route, some of the practices of the so-called Bates system.

Visual exercises which are most familiar to ophthalmologists relate to the development of improved neuromuscular coordination of the two eyes. This is the well known field of orthoptics, in the restricted sense of the term. I shall merely mention one or two points bearing on this work. Manifest deviations, actual squints, are relatively rare as compared with the number of latent deviations. Orthophoria is the exceptional finding, some horizontal and, less commonly, some vertical heterophoria being the rule. Now, when a patient with a refractive error shows also an appreciable amount of heterophoria, what is the physician to do? One way is to correct the ametropia, ignore the heterophoria and wait a month or two. If the patient's complaints of discomfort persist after correction of the ametropia, then the physician must attend to the heterophoria.

Another way is to make the red glass test before prescribing the lens correction. If with mere discoloration of the images, preferably that of the nondominant eye, dissociation and diplopia result and if, in addition, the images stay apart or come together slowly, then the imbalance is likely to be a factor in the patient's discomfort. In such cases it is advisable to do something about the imbalance at the time of correcting the ametropia.

There are two ways of treating the imbalance. One is to incorporate a prism for relief. Another and, whenever possible, a better way, is to give a series of visual exercises in order to build up fusion and reserve duction power. Dr. Burian's work on the importance of peripheral stimuli in the development and maintenance of fusion has clarified many puzzling points in fusion training. In fact, targets for these exercises should be made on the basis of Dr. Burian's findings.

Now and then one reads in the lay, and sometimes in the professional, press of eye exercises consisting of wall to wall and floor to ceiling movements. I think such exercises are senseless, for these movements are constantly being made in the ordinary course of daily use of the eyes. What is needed are movements which are not ordinarily made—and these are primarily forced duction or vergence movements in which the eyes are made to move in opposite directions. These exercises build up reserve power, but they are not muscle exercises. They are, rather, procedures for developing smooth neuromuscular pathways, probably akin to conditioned reflexes.

There are many elaborate instruments for use in training, but these exercises can also be effectively given by the application of simple prisms. These prisms can be employed in a variety of ways to provide rhythmic or sustained exercises, with use of the step method or the sliding method or a combination of the two. In all cases, however, the eyes should be made to execute various conjugate movements while under the tension of the prism. A simple stereoscope can also be of aid and is especially effective when used with the pointer method, a procedure which I first described about twelve years ago.[4]

4. Pascal, J. I.: Visual and Orthoptic Training, Am. J. Ophth. **17**:801 (Sept.) 1934.

CONCLUSION

I believe that all these visual exercises belong in the domain of ophthalmology. But not every ophthalmologist is fitted either by temperament or by inclination to engage directly in this work. For the training is largely in the nature of teaching and requires special aptitude and skill on the part of the teacher. A man may be a first rate ophthalmologist and a third rate teacher. It is at this juncture that the orthoptic technician comes to the fore. Such a technician can be trained to apply intelligently all these varieties of visual exercise under the supervision of the ophthalmologist. The fact that these technicians are mostly women is probably not an accident. Women usually excel in teaching elementary skills; they generally have more patience, tact and enthusiasm for the work. But in all cases their work should be under the critical supervision of a well informed ophthalmologist who is in sympathy with this type of work.

37 West Ninety-Seventh Street.

Clinical Notes

A MODIFIED SLING OPERATION FOR CORRECTION OF PTOSIS

JOSEPH LAVAL, M.D., NEW YORK

For the correction of ptosis in the absence of action of the levator muscle two procedures are open to the surgeon. One is to utilize the superior rectus muscle if it is active, as in the Motais procedure,[1] and the other is to make a sling which will lift the lid, as in the Machek procedure,[2] when the superior rectus muscle is paralyzed. The latter method is a modified Panas operation,[3] or a Hunt-Tansley procedure, in which the skin of the upper lid is utilized for the sling. Instead of utilizing skin of the upper lid for the sling, Derby,[4] and later Wiener and Alvis,[5] used fascia lata.

In 1924 Reese[6] suggested using strips of orbicularis muscle and pretarsal fascia to pro-

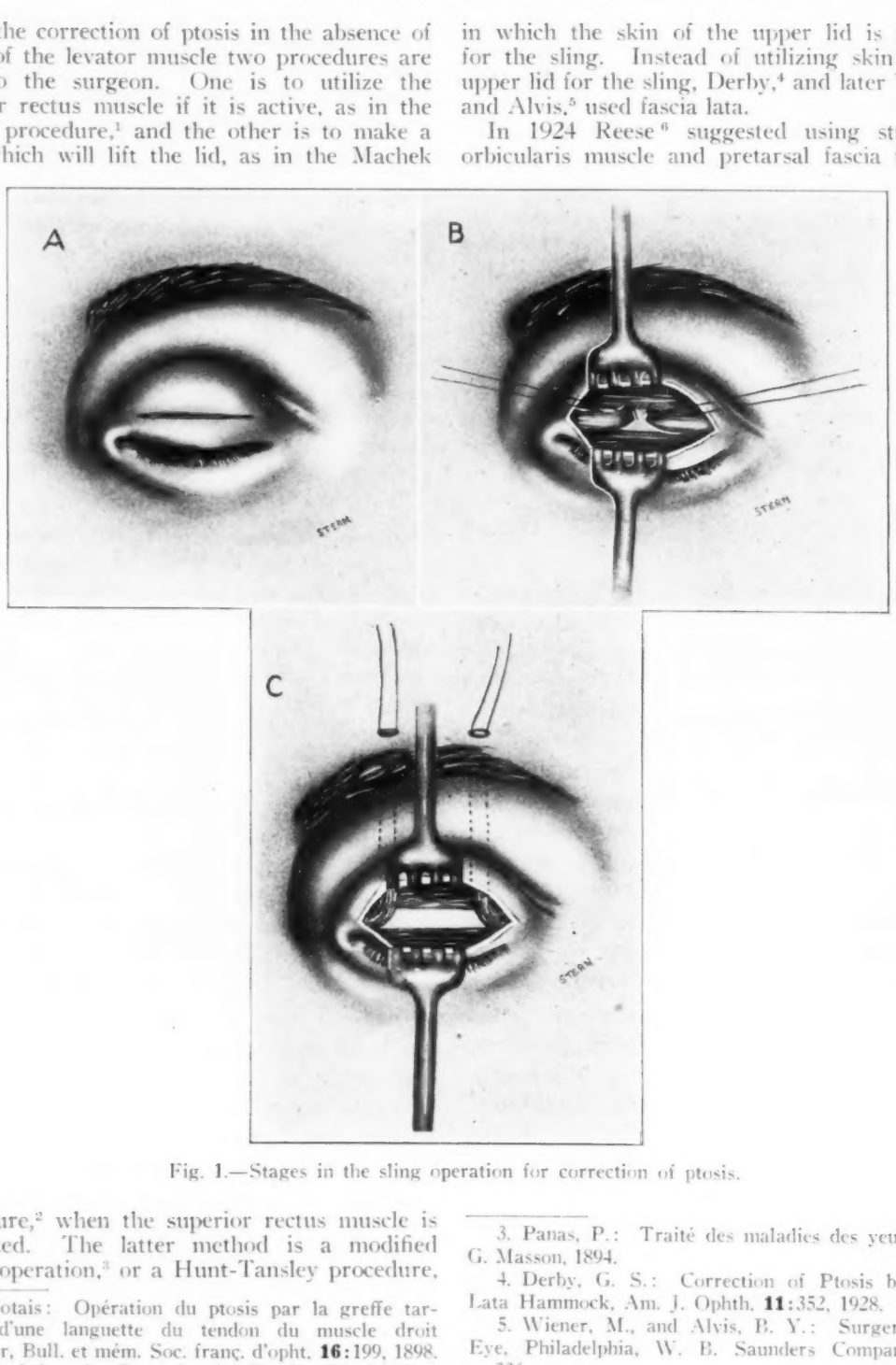


Fig. 1.—Stages in the sling operation for correction of ptosis.

1. Motais: Opération du ptosis par la greffe tarsienne d'une languette du tendon du muscle droit supérieur, Bull. et mém. Soc. franç. d'opht. **16**:199, 1898.

2. Machek: An Operation for Ptosis with the Formation of a Fold in the Upper Lid, Arch. Ophth. **44**: 539, 1915.

3. Panas, P.: Traité des maladies des yeux, Paris, G. Masson, 1894.

4. Derby, G. S.: Correction of Ptosis by Fascia Lata Hammock, Am. J. Ophth. **11**:352, 1928.

5. Wiener, M., and Alvis, B. Y.: Surgery of the Eye, Philadelphia, W. B. Saunders Company, 1939, p. 326.

6. Reese, R. G.: Operation for Blepharoptosis with Formation of a Fold in Lid, Arch. Ophth. **53**:26, 1924.

duce a sling. I have simplified and modified his procedure, as described here.

An incision is made through the skin and subcutaneous tissue of the upper lid 2 mm. above the tarsal edge (fig. 1 *A*). The incision extends the full width of the lid, and the margins are dissected free from the underlying orbicularis muscle.. The latter is then lifted up with forceps, and a strip 3 mm. wide is prepared just above the upper tarsal margin. This strip extends the full width of the lid, just as the original incision in the skin was made. The temporal and nasal attachments of the strip of orbicularis muscle are not dissected but are left in position. The strip of muscle is cut in half at its center, and a mattress suture of braided silk on a full curved needle is passed through each cut end (fig. 1 *B*). (In the Reese procedure the orbicularis muscle plus fascia is dissected and the lateral ends are freed, the central portion remaining attached.) Two tunnels are then dissected under the skin of the upper lid to the brow, emerging through the skin just above the eyebrow. One tunnel is along the nasal portion and the other along the temporal portion of the lid, and the two tunnels proceed straight upward. The full curved needles of one strip of orbicularis muscle are then passed through the corresponding tunnel and deep bites taken down to the periosteum and out through the skin of the exit of the tunnel. The same procedure is carried out with the needles of the other srtip of orbicularis muscle (fig. 1 *C*). The sutures are then drawn as tight as possible and tied over rubber pegs. The incision through the skin of the lid is sutured with a continuous fine silk suture on an atraumatic needle. (In the Reese procedure an anchor suture is taken through the center of the tarsal tissue of the lid and brought out on the brow; the sutures through the strips of orbicularis muscle are not attached to the periosteum but are brought directly through the incision in the skin above the eyebrow.) A Wheeler cone is then applied and left in place for five days, at the end of which time the running suture in the lid is removed. On the seventh day the silk sutures which hold the strips of orbicularis muscle attached to the periosteum are removed.

This procedure is recommended in cases in which the levator and the superior rectus muscles are completely paralyzed. If the levator muscle is active to any degree, a resection of this muscle is by all means the operation of choice. If the superior rectus muscle is active, a Motais or a Wheeler [7] operation, using a sling of orbicularis muscle under the superior rectus muscle, is advocated. Dickey [8] uses a sling of fascia lata which he attaches to the superior rectus muscle.

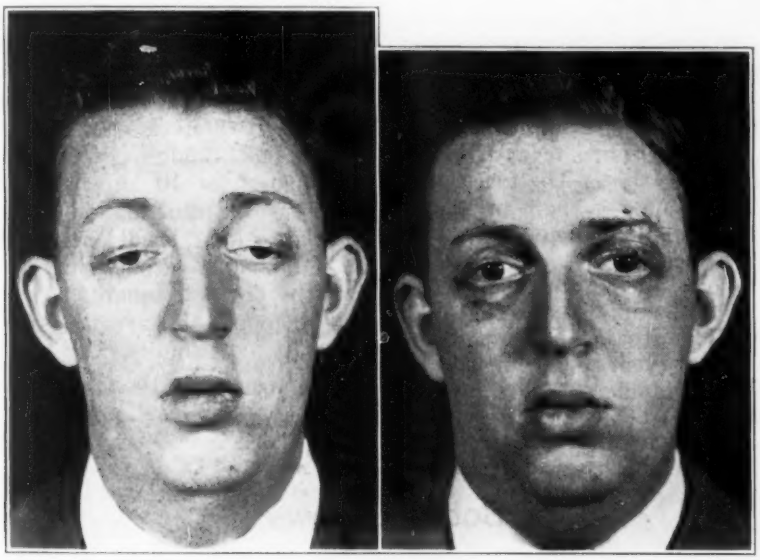


Fig. 2.—At left, appearance before operation. At right, left eye two weeks, and right eye two months, after operation.

136 East Sixty-Fourth Street.

7. Wheeler, J. M.: Correction of Ptosis by Attachment of Strips of Orbicularis Muscle to Superior Rectus Muscle, Arch. Ophth. **21**:1 (Jan.) 1939.

8. Dickey, C. A.: Superior-Rectus Fascia-Lata Sling in Correction of Ptosis, Am. J. Ophth. **19**:660, 1936.

Correspondence

ILLUMINATION FOR THE OPHTHALMOLOGIST

To the Editor:—In the January 1945 issue of the ARCHIVES, page 1, appeared a lucid and simplified discussion on "Elementary Illumination for the Ophthalmologist," by Dr. Legrand H. Hardy and Dr. Gertrude Rand. The subject was thoroughly covered. There is, however, one point with reference to the units employed in illumination which, in my experience, has proved a stumbling-block to ophthalmologists and which can, perhaps, be still more simplified. This pertains to the difference and/or the relation between the foot candle (or the meter candle, or lux) and the lumen.

It is, of course, more scientific to define the foot candle in terms of the lumen, but it is easier to understand both by regarding them as different, in some such way as this: The foot candle may be thought of as a unit of "light pressure," or "light density," or "intensity of concentration of light," as Drs. Hardy and Rand phrased it. The foot candle is most simply and commonly defined as the illumination received on a surface which is 1 foot from a light source of 1 candle power. On every point of such a surface there is 1 foot candle of light pressure, or light concentration.

The lumen is best thought of as a unit of the amount or quantity of light received on a unit area of a surface, the light pressure or light concentration on which is given in terms of foot candles, or meter candles. One lumen is the quantity of light received on 1 square foot of a surface which has an illumination (light pressure) of 1 foot candle. In some rough way, this is analogous to what almost every one is familiar with in electricity. The volt is a unit of electrical force, or pressure, and the ampere is a unit of the amount of electricity.

Thus, on a surface which has an illumination of, say, 10 foot candles, i. e., a light pressure of 10 foot candles, each square foot has an illumination of 10 lumens. One-half a square foot has an illumination of one-half this (5 lumens of light), and one-tenth square foot has an illumination of one-tenth this, i. e., 1 lumen. But the one-half square foot and the one-tenth square foot both have the same light pressure, i. e., 10 foot candles.

JOSEPH I. PASCAL, M.D., New York.
37 West Ninety-Seventh Street.

Book Reviews

The March of Time. The New York Academy of Medicine Lectures to the Laity. Price $1.75. Pp. 121. New York: Columbia University Press, 1945.

The ninth annual series of lectures on timely subjects to the laity by prominent leaders are now made permanent and available to a larger circle of readers by this publication of the New York Academy of Medicine.

After a foreword by Dr. Arthur F. Chace, the president of the Academy, and an introduction by Dr. Harold R. Mixwell, chairman of the committee on medical information, the six lectures follow.

The subjects of the lectures are as follows: "Morale and Propaganda," Dr. Edward A. Strecker; "Food and Civilization," Dr. Charles G. King; "The Past, Present and Future of Chemotherapy," Dr. Colin M. McLeod; "Medicine and the Changing World," Dr. Reginald Fitz; "The Effects of Science upon Human Beings," Sir Gerald Campbell, and "Wars and Epidemics," Lieut. Col. Thomas T. Mackie. This is an admirable collection of topics, both for their timeliness and for the excellent selection of the subject matter.

These lectures help to keep up the educational value which the series have attained in previous years. The present lectures relate to this war period and the changing world, and the thoughtful reader will be well repaid by their perusal.

ARNOLD KNAPP.

Eye, Ear Nose and Throat Manual for Nurses. By Roy H. Parkinson, M.D., F.A.C.S. Fifth edition. Price, $2.25. Pp. 247, with 82 illustrations, 2 in color. St. Louis: C. V. Mosby Company, 1944.

This manual was favorably reviewed in the ARCHIVES (**17**: 388 [Feb.] 1937). It has now been brought up to date, with a small increase in the number of pages and the addition of a number of new illustrations. It should continue to be popular and useful.

ARNOLD KNAPP.

Abstracts from Current Literature

EDITED BY DR. WILLIAM ZENTMAYER

Conjunctiva

OBSERVATIONS ON THE TRANSPARENCY OF THE CONJUNCTIVA. P. A. GARDINER, Brit. J. Ophth. **28:** 538 (Nov.) 1944.

The aim of the author is to define the normal appearance of the conjunctiva and to elucidate, if possible, the causes of deviations from the normal, with particular reference to the part nutrition might play.

Slit lamp examination was made of large numbers of subjects of both sexes of different nationalities, living in different climatic conditions and on different diets. The ages ranged from 9 to 37 years. Experiments were performed on several groups of subjects.

The anterior half of the nasal and temporal segments of the interpalpebral bulbar conjunctiva was examined with the slit lamp. The following conclusions are arrived at:

The transparency of the interpalpebral bulbar conjunctiva increased between the ages of 9 and 37 years in the absence of hyaline degenerative changes. In those subjects in whom hyaline degenerative changes were found, the areas which were spared showed increased transparency with age.

The rate of change was most rapid between the ages of 17 and 30 years and was less at the two extremes of the age range examined.

The females examined showed a constantly more transparent conjunctiva than males between the ages of 9 and 27 years.

Nutritional factors probably play a part in influencing the transparency of the conjunctiva. A good diet tends to increase opacity whereas a bad diet increases transparency between the ages of 9 and 37 years.

There was an association, probably through nutrition, between the transparency of the conjunctiva and increased vascularity of the limbus. Slit lamp examinations of the conjunctiva of a group of subjects enable deductions to be made as to nutritional well-being of the group.

W. ZENTMAYER.

Cornea and Sclera

EFFECT OF RIBOFLAVIN ON CORNEAL VASCULARIZATION AND SYMPTOMS OF EYE FATIGUE IN ROYAL CANADIAN AIR FORCE PERSONNEL. F. F. TISDALL, J. F. MCCREARY and H. PEARCE, Canad. M. A. J. **49:** 5 (July) 1943.

Tisdall and his collaborators attempted to demonstrate photographically the changes which occur in the cornea in riboflavin deficiency. Kruse and his co-workers had suggested that the minor degrees of vascularization of the cornea frequently seen in apparently normal human beings were due to a deficiency of riboflavin. They postulated that symptoms of tiredness of the eyes, burning of the eyes, a sandy sensation under the lids and lacrimation might be manifestations of the deficiency and might be cleared by the administration of riboflavin. Riboflavin is rapidly destroyed by light, and it seems possible that a person who is exposed to a great deal of light would have an increased destruction of riboflavin in the eye, which would necessitate a greater intake to maintain normal vision and health. Men in the air forces are exposed to much light. The authors investigated the various degrees of vascularization of the cornea in men who were flying over water and exposed to considerable glare. One hundred and ninety-eight men were examined. Only 1 man had normal eyes; 17 showed stage 1 involvement; 87 had stage 2, and 93, stage 3. A group of men showing stage 3 involvement were chosen to demonstrate the effect of treatment on vascularization of the cornea and the symptoms of fatigue of the eyes. These men were questioned regarding tiredness of the eyes, aching of the eyes, watering of the eyes, sandy sensation under the lids, dizziness, headaches, intolerance of reading and decreased visual acuity. Sixty-seven per cent had two or more of these symptoms. The men were divided into three groups. One group received capsules containing 3.3 mg. of riboflavin three times daily for two months; the second group received similar capsules three times daily for one month, and the third group received capsules which were similar in appearance but which contained no riboflavin. Of the 28 men who received treatment with 9.9 mg. of riboflavin daily for two months, 20 showed either pronounced or moderate improvement; 8 showed either slight or doubtful improvement or no change, and none showed increase in vascularization of the cornea. Of the 21 men who received treatment for one month, 6 showed pronounced or moderate improvement; 14 showed slight or doubtful improvement or no change, and 1 man showed an increase in vascularity. Of the 21 men treated with placebos, none showed either pronounced or moderate improvement; 15 showed slight or doubtful improvement or no change, and 6 were worse. In areas where milk, the best source of riboflavin in the diet, was not

available, the prevalence and the severity of corneal vascularization were increased.

J. A. M. A. (W. ZENTMAYER.)

HERPES CORNEAE AND VIRUS INFECTION. A. LOEWENSTEIN, Glasgow M. J. **141:** 54 (Feb.) 1944.

This discussion of herpetic keratitis and virus infections of the eye, by Prof. A. Loewenstein, of Prague, Czechoslovakia, was delivered as a postgraduate lecture on Sept. 15, 1943, at the Tennent Institute of Ophthalmology, University of Glasgow. Loewenstein gives a historical survey of herpes corneae, beginning with the demonstration seventy years ago by Horner of the specific nature of corneal ulcer combined with anesthesia of the cornea and continuing with the demonstration in 1911 by Grueter of the transmissibility of corneal herpes to the cornea of rabbits. The pathology of the disease is discussed, with particular reference to the relation of the virus to the corneal nerves and to the intranuclear inclusion bodies. Histologic studies by the author failed to demonstrate any damage to the nerve fibers in the experimental disease in rabbits, but the linkage of hypesthesia or anesthesia to all clinical forms of human herpes of the cornea makes the presence of such damage probable. The author explains the difference between spontaneous herpes of the human cornea and inoculation herpes of the rabbit cornea on the basis of differences in the nerve fiber patterns, the nerve fibers in the human cornea showing dichotomous branching without anastomoses and the nerve fibers in the rabbit cornea showing numerous anastomoses.

The author states that one type of herpes zoster ophthalmicus, herpes iridis Machek, or iritis herpetica, is restricted to mesodermal tissue. It is an iritis beginning with neuralgia of the first branch of the trigeminal nerve, with or without typical cutaneous involvement, and including swelling of the iris tissue, roseola and hyphemia. Extensive vitiligo of the iris may occur. The relationship of this virus to the virus of chickenpox is noted, and the occurrence of a typical case of vitiligo iridis accompanying chickenpox is described.

Brief surveys of other virus diseases, including smallpox, epidemic keratoconjunctivitis, measles, verruca, molluscum contagiosum, lymphogranuloma venereum, trachoma and inclusion conjunctivitis, are presented.

PHILLIPS THYGESON.

THE CORNEAL GRAFT FROM CADAVER CORNEA. PEREZ-BUFIL, Arch. Soc. de oftal. hispano-am. **3:** 464 (Nov.-Dec.) 1943.

Perez-Bufil's first experience in corneal grafting operations was in 1906, when he used heteroplasty, with poor results. Later he used homokeratoplasty experimentally, having obtained the best results with crossed sutures from limbus to limbus to hold the transplant. In his experience Castroviejo's continuous suture has produced a severe keratitis, which interferes with healing.

An operation was performed on a woman aged 45 with total leukomas of both corneas. The transplant was obtained from a cadaver twenty-four hours after death. A cataractous lens was found behind the opaque cornea. Although the prognosis was considered unfavorable, the graft took, and sixteen months after the operation vision has improved to ability to count fingers at 60 cm. and the perception of colors. Further improvement is expected.

In a second case, operation was performed on a woman aged 50 with sclerosing keratitis. The donor was a three months premature baby who had died nine hours before. This patient's vision was also improved, notwithstanding the presence of lesions in the fundus.

H. F. CARRASQUILLO.

Experimental Pathology

CORNEAL HEALING: ADHESIVE POWER OF AQUEOUS FIBRIN IN THE RABBIT. A. L. BROWN and F. A. NANTZ, Am. J. Ophth. **27:** 1220 (Nov.) 1944.

Brown and Nantz give the following summary:

"1. The wound edges after an incision in the rabbit cornea are approximated strongly by the secondary aqueous.

"2. A wound surrounding a transplant will support 11,000 times the weight of the transplant in four hours.

"3. This sealing is accomplished by the fibrin produced in the aqueous.

"4. The aqueous fibrin is a product of the union of thrombin from the wound edges and fibrinogen in the aqueous.

"5. Heparin was injected into the anterior chamber to replace aspirated aqueous. This agent markedly decreased the adhesive power of the secondary aqueous after corneal incision.

"6. The heparin was then replaced by thrombin-fibrinogen and the adhesive power was restored.

"7. No comparable action occurs in man. There is no more than a trace of fibrinogen in human aqueous and a correspondingly diminished adhesive power." W. S. REESE.

CHANGES IN THE INDEX OF REFRACTION IN THE OCULAR MEDIA IN ANIMALS SUBJECTED TO THE ACTION OF SULFONAMIDE COMPOUNDS. J. PEREZ LLOVEA and J. J. ALMEÑARA, Arch. Soc. de oftal. hispano-am. **3:** 425 (Nov.-Dec.) 1943.

The presence of slight transitory myopia during the course of sulfonamide therapy has been

observed in recent years. The authors have conducted experiments on animals to determine whether the presence of these compounds in the ocular media in vitro could bring about changes in their index of refraction capable of explaining the myopia observed clinically.

The result of their observations was that the changes in the refractive index of the media of eyes under experimentation was so slight that the clinical observations could not be attributed to that change. Changes in the refractive index occurred only in the fifth cipher in concentrations which could be obtained in patients receiving sulfonamide therapy. H. F. CARRASQUILLO.

General Diseases

A CASE OF POLYCYTHAEMIA VERA—EXTRACTION OF BOTH LENSES. SATISFACTORY RESULT. J. C. MARSHALL, Brit. J. Ophth. **28:** 481 (Oct.) 1944.

Marshall successfully removed a cataract from each eye of a man aged 74 with polycythemia vera. The blood count revealed 7,250,000 red cells and 12,000 white cells.

Ophthalmoscopic examination of the right eye was impossible, owing to "advanced cataract." In the left eye the disk was suffused, and there was a hemorrhage at the macula. The resulting visual acuity was 6/6 in each eye. In the right eye there was a patch of old choroiditis, resembling Tay's choroiditis, which was outside the macula. Care must be taken not to confuse the condition with that of a cerebral tumor associated with headache and papilledema.

W. ZENTMAYER.

CHEMOTHERAPY OF TUBERCULOSIS OF THE EYE: REPORT OF CASES. A. MIKLÓS, Klin. Monatsbl. f. Augenh. **106:** 20 (Jan.) 1941.

Miklós reviews the use of metals, especially gold, in the treatment of tuberculosis of the eye. The results were not encouraging. Toxicity was observed, involving the liver, digestive tract, skin and kidneys. A new combination, rubrophen, was used with success at the ophthalmic hospital of the University of Debrecen (Hungary) for a number of years.

Rubrophen consists of trimethoxydioxyoxotritan ($C_{22}H_{20}O_6$). Fifty patients were treated—3 with chronic iridocyclitis; 9 with iritis, with subacute iridocyclitis; 5 with sclerokeratitis; 1 with sympathetic ophthalmia; 2 with perivasculitis retinalis; 2 with choroiditis; 3 with tuberculous keratitis, and 20 with severe eczematous keratoconjunctivitis. A number of case histories are discussed. Rubrophen proved its value for several forms of tuberculosis of the eye, improvement becoming evident swiftly in some of them. Results showed slowly, after several months, in some patients with iridocyclitis. The application of rubrophen should not be discontinued after initial failure in treatment of uveitis, sympathetic ophthalmia, angiopathia retinae and other chronic inflammations.

Recurrences took place at longer intervals, although they might occur after apparently complete recovery. The author agrees with other writers, who recommend that for several years after recovery rubrophen be used during the favorable seasons, spring and fall. Rubrophen, like tuberculin, has to be used for long periods.

K. L. STOLL.

Glaucoma

TENOTOMY OF THE RECTUS MUSCLES IN GLAUCOMA. A. GARTNER and R. K. LAMBERT, Am. J. Ophth. **27:** 1228 (Nov.) 1944.

Gartner and Lambert report 2 cases of absolute glaucoma in which they tenotomized the rectus muscles, causing a temporary reduction in tension. In the first case there was a reduction in tension of from over 70 to 50 mm. of mercury (Schiötz). The reduction lasted six weeks and was followed by a gradual increase to 70 mm. of mercury in three months. In the second case the eyeball was stony hard. The cornea was gray and vascular. The surface was irregular and presented vesicles. After the operation the corneal condition improved. Tension was 34 mm. of mercury for over six weeks and then rose to 40 mm., where it stayed for the three months prior to the time of the report. The patient was much relieved by the operation. The authors state that they were unaware when they performed the operations that Sapir had used the same procedure in 43 cases of various types of glaucoma. W. ZENTMAYER.

NOTES ON AN OPERATION FOR GLAUCOMA. R. J. MASTERS, Am. J. Ophth. **27:** 1371 (Dec.) 1944.

Masters describes an operation which he has been performing for ten years. It is a combination of cyclodialysis, iridectomy and fistulization, the formation of a fistula being effected by a ragged, flaplike incision. This paper is a preliminary report. W. S. REESE.

Injuries

TRAUMATIC ENOPHTHALMOS. J. L. MALBRAN and F. GARCIA NOCITO, Arch. de oftal. de Buenos Aires **18:** 655 (Dec.) 1943.

The authors report 7 cases of this symptom complex and state that a total of 157 cases appear in the literature. Males are more likely to be affected than females. The condition is chiefly seen in youth and mature life, but a case of a patient 12 years old and another of 60 have been reported. The syndrome may be produced by several types of wounds, but contusion in the

neighborhood of the orbit is particularly likely to cause it. Cases in which the globe is dislocated after destruction of the orbital walls are not included.

Usually, the syndrome makes its appearance a few weeks after the trauma, but in some cases it has occurred as early as six hours afterward and in others one year later.

The amount of enophthalmos usually averages 3 to 5 mm., but as much as 35 mm. has been seen.

The appearance is that of an artificial eye, as the fold in the upper lid is lost. Paralysis or paresis of the muscles frequently accompanies the condition. In about half the cases reported vision was preserved; in the others visual acuity was diminished even to complete blindness. The visual field may be contracted. In some cases a central scotoma is present. The pupil is usually dilated; fixed miosis is the exception. Accommodation may be normal or altogether paralyzed. Hypotension, trophic disturbances of the same side of the face and paresthesias in the region of distribution of the trigeminal nerve are frequent. Lesions in the lacrimal apparatus also occur.

As to the theories of its causation, rupture of the trochlea and a lesion of the sympathetic fibers have been mentioned. Enlargement of the osseous cavity of the orbit by fracture or by atrophy of the retrobulbar tissue, cicatricial retraction and destruction of the suspensory ligaments of the eye have also been considered causative factors.

The authors give in detail the history and findings in the cases which they studied and a summary of the cases reported in the literature.

H. F. CARRASQUILLO.

PROSTHESES AFTER MILITARY TRAUMA OF THE ORBIT. D. SUDAKEWITCH, Vestnik oftal. **22:** 25, 1943.

The orbital injuries during the Russo-Finnish war constituted about 11 per cent of all orbital injuries. Sudakewitch classifies orbital injuries as (*a*) orbital, (*b*) orbitalfrontal, (*c*) orbitalnasal and (*d*) orbitalzygomatic, a classification which is correlated with the functional-topographic character of the orbital and the adjacent cavities and with the material of which the prostheses are made.

In the repair of orbital injuries the prosthesis should be firm and nonflexible. For orbitolzygomatic injuries the prosthesis should be of elastic material, because of the many muscles attached to the zygoma and cheek; for fronto-orbital and frontonasal injuries the prosthesis should be thin but nonelastic. A combination can be used, according to each individual case.

O. SITCHEVSKA.

Lacrimal Apparatus

PERMEABILIZATION OF THE LACRIMAL PASSAGES. A. P. GUILLEM, Arch. Soc. de oftal hispano-am. **3:** 487 (Nov.-Dec.) 1943.

Instrumental dilation of the lacrimal passages produces an anatomic alteration of the walls of these passages, and the condition of epiphora persists. With the aim of conserving the anatomic integrity of these passages, the author uses electrocoagulation. Thirty-one patients have been treated successfully. A fine lacrimal sound with an insulating covering, except at its tip, is used to catheterize the passages. When the obstruction is encountered, the circuit is made for a short time, a current of 80 to 100 milliamperes being used, and the sound is pushed in. After this initial permeabilization, dilation is performed daily for eight or ten days.

H. F. CARRASQUILLO.

Neurology

MECHANISMS OF HEADACHE. H. WOLFF, Arch. Neurol & Psychiat. **50:** 224 (Aug.) 1943.

This excellent review summarizes the author's extensive investigation of this subject.

Six basic mechanisms for headache from intracranial sources are formulated: (1) headache from traction on veins that pass to the venous sinuses and from displacement of the great venous sinuses; (2) traction on the middle meningeal arteries; (3) traction on large arteries at the base of the brain and their branches; (4) distention and dilatation of intracranial arteries; (5) inflammation in or about any of the pain-sensitive structures of the head, and (6) direct pressure by tumors on cranial or cervical nerves containing pain afferent fibers from the head.

The author defines the pain-sensitive structures of the head as (1) all tissues covering the cranium, particularly the arteries, and (2), of the intracranial structures, the great venous sinuses, parts of the dura at the base, the dural arteries and cerebral arteries at the base of the brain, the fifth, ninth and tenth cranial nerves and the upper three cervical nerves.

Stimulation of pain-sensitive structures on or above the superior surface of the tentorium cerebelli resulted in pain in various regions in front of a line drawn vertically from the ears across the top of the head, the pathways for this pain being contained in the fifth cranial nerve.

Stimulation of pain-sensitive structures below the inferior surface of the tentorium cerebelli resulted in pain in various regions behind the aforementioned line, the pathways being contained in the ninth and tenth cranial and the upper three cervical nerves.

The investigator suggests that headache associated with increased or decreased intracranial

pressure results from traction on or displacement of pain-sensitive intracranial structures and is independent of changes in pressure of themselves.

The localizing value of headache associated with tumor of the brain as it pertains to the position of the tumor is reviewed.

Wolff then discusses histamine headache; headache associated with fever; migraine headache; headache associated with hypertension, and the muscles of the scalp and neck as sources of pain.

With relation of headache to the eyes, investigations were made on pain-sensitive structures, superficial and deep, of the eye; on the headache and aching of eyes associated with refractive errors and imbalances of the extraocular muscles, and on photophobia. Increased intraocular pressure produced a sharp pain which at first remained localized, but later extended along the rim of the orbit and finally involved most of the area supplied by the ophthalmic division of the trigeminal nerve. Experimentally induced hyperopia and astigmatism caused headache, while induced myopia did not. Induced imbalance of the extraocular muscles caused tension and irritability and, if prolonged headache developed, abnormal electromyograms from the muscles of the scalp and neck. Normally occurring muscle imbalances produced similar symptoms and myograms.

Finally, the pain associated with nasal and paranasal structures is discussed—"the sinus headache." Inflammation and engorgement of turbinates, ostiums, nasofrontal ducts and superior nasal spaces are responsible for most of the pain radiating from the nasal and paranasal structures. If headache is not associated with engorgement and inflammation of the turbinates, it is in all probability not a result of disease of the nasal or paranasal structures. Furthermore, if headache in the zygomatic, frontal or temporal region or over the vertex is not greatly reduced in intensity or eliminated by shrinkage or local anesthetization of nasal structures, it is in all probability not due to disease of the nasal or paranasal structures.

R. Irvine.

Ocular Symptoms of the "Sacred Disease" [Epilepsy]. R. Argañaraz, Arch. de oftal. de Buenos Aires **18:** 546 (Nov.) 1943.

The author gives the following ocular symptoms of epilepsy (called the "sacred disease" by Hippocrates): enlargement of the blindspot of Mariotte and contraction of the internal isopters of 2/2000; congestion or true neuritis, and either primary or secondary atrophy of the optic disk. Attention is called to the fact that these findings are not mentioned in any textbook. Epilepsy should be diagnosed by the oculist.

Seven cases are presented to illustrate these features. Campimetric illustrations appear in the article.

H. F. Carrasquillo.

Ocular Muscles

Congenital Paralysis of Both External Recti Treated by Transplantation of Eye Muscles. J. A. Magnus, Brit. J. Ophth. **28:** 241 (April) 1944.

Magnus operated on a patient with bilateral abducens paralysis and pronounced right hyperphoria due to an overacting right inferior oblique muscle. The O'Connor technic of transplantation was used. The cosmetic effect was satisfactory, but abduction was practically impossible. An unusual finding was abnormal thickness of the external rectus muscle, with an abnormal anatomic position of the left eye.

W. Zentmayer.

The Effects of Faradically Induced Currents upon the Extrinsic and Intrinsic Ocular Musculature: A Clinical Self Experiment. J. H. Young, Brit. J. Ophth. **28:** 488 (Oct.) 1944.

Young performed the experiments on himself. The Smart-Bristow electric induction apparatus, with a modification required for the experiments, is described. The phenomena resulting from faradic stimulation of the left internal rectus muscle are reported in detail; the experimental signs and symptoms are briefly recapitulated, and the physiology of the reaction experienced is discussed. Faradically induced electric currents have been shown to be capable of producing three important ocular signs: exophthalmos, nystagmus and spasm of accommodation, all mediated through the autonomic nervous system.

It is considered that with the advent of modern general anesthesia and with due safeguarding as regards the type of patient and the strength of current, with or without the use of homatropine as required, faradism should prove helpful in treatment of the various muscular anomalies resulting from war trauma or those of other origin. It should also prove useful in the diagnosis and prognosis of lesions of the ocular muscles.

W. Zentmayer.

Operations

Plastic Spheres for Implantation into Tenon's Capsule in the Frost-Lang Type Operation for Enucleation of the Eyeball. R. E. Wright, Brit. J. Ophth. **28:** 573 (Nov.) 1944.

Wright uses plastic spheres perforated in two diameters at right angles and fluted on the surface in a sort of basket work pattern. These spheres are anchored to the superior and inferior

rectus muscles by surgical gut passed through the vertical tunnel and to the lateral muscles by way of the horizontal tunnel. The sutures are tied over the top of the globe. A purse string surgical gut suture is then passed round the mouth of the bag, alternate bites of Tenon's capsule and cut muscle extremities being picked up and tied off. The fluting of the globe is intended to supplement the fibrous tissue anchorage which eventually takes place. Nothing but a double shell (reform prosthesis) or a carefully filled plastic prosthesis should be used.

W. ZENTMAYER.

PREVENTION OF HEMORRHAGIC COMPLICATIONS IN THE ORBITAL ANESTHESIA. B. CARRERAS, Arch. Soc. de oftal. hispano-am. **3:** 420 (Nov.-Dec.) 1943.

Reference is made to an article in which it is stated that orbital hemorrhage could be avoided by using very fine hypodermic needles (not more than 0.7 mm. thick) with a very sharp point.

The method advocated by the author consists in using two hypodermic needles, one very fine and pointed for a preliminary subcutaneous injection, and another with a dull point, which is pushed through the previously anesthetized skin into the deep tissues of the orbit. The fluid should be injected ahead of the advancing needle.

The retrobulbar method of anesthesia and that for operation on the lacrimal sac are fully discussed.

H. F. CARRASQUILLO.

Pharmacology

EFFECT OF YEAST EXTRACTS ON LOCAL ANESTHETIC ACTIVITY OF COCAINE. E. S. COOK, Proc. Soc. Exper. Biol. & Med. **54:** 203 (Nov.) 1943.

"Addition of a yeast extract to cocaine hydrochloride solutions reduces the corneal anesthetic potency, this reduction being especially notable when the p_H of the treated solution is lowered to the level of the control solution. There is evidence that the subcutaneous toxicity of cocaine is also decreased by the extract."

P. C. KRONFELD.

THE DIONIN EFFECT IN THE CONJUNCTIVA. A. LOEWENSTEIN, Brit. J. Ophth. **28:** 622 (Dec.) 1944.

The observations of Loewenstein confirm previous reports that perivascular lymph vessels are commonly observed in cases of subconjunctival hemorrhage four or five days after its occurrence. They can be seen to accompany conjunctival vessels which cross the area of hemorrhage. The width of the sheath on each side of the vessel is approximately equal to that of the blood column and is sharply defined. It is assumed that the whitish yellow sheaths surrounding the vessels within the hemorrhagic area are lymph paths. They can be visible only when the hemorrhage is confined to the plane of the vessels. If the hemorrhage were superficial, it would conceal both the blood column and the lymph sheath; if it were deeper, it would form a dark background to the vessel and obscure the white sclera, which is essential to render visible the transparent lymph space. The lymph vessels disappear in from forty to sixty seconds after the instillation of a solution of ethylmorphine hydrochloride, concurrently with the onset of the conjunctival edema, and reappear in from thirty to fifty minutes as the edema passes off. The edematous fluid in the conjunctiva, at first clear, becomes milky after fifteen to thirty minutes.

The article is illustrated.

W. ZENTMAYER.

Physiology

FUNCTIONAL POLARIZATION IN RETINAL DEVELOPMENT AND ITS REESTABLISHMENT IN REGENERATING RETINAE OF ROTATED GRAFTED EYES. L. S. STONE, Proc. Soc. Exper. Biol. & Med. **57:** 13 (Oct.) 1944.

When the eye of the adult salamander is grafted or when its blood supply is temporarily interrupted, the retina always degenerates and regeneration occurs from surviving peripheral cells. When the optic nerve is cut without interference with the blood supply to the retina, the retina survives and the nerve immediately regenerates.

In animals subjected to one of these procedures the visuomotor responses to lures approaching any of the four quadrants of the field of vision and to a rotating black and white drum were studied. Normally the animal moves toward, snaps at and follows the lure and moves automatically head and body in the same direction as the drum when the latter rotates temporonasally through the field of vision.

In one group of animals, one eye was merely turned upside down (180 degree rotation of all quadrants) and fixed in the new position after the conjunctival and muscular attachments were cut, without injury to the optic nerve or to the blood supply of the retina. Thus the animal retained its original intact retina, but the localizing functions of each quadrant became reversed. When the lure was brought into the field of each of the four retinal quadrants, the animal reversed its reactions and sought for the lure in the opposite direction. When the eye was rotated back to its normal position, normal visuomotor reactions were restored.

When the eye was excised and reimplanted upside down, return of vision through the new retina showed complete reversal of the localizing function of each retinal quadrant, as in the case of the rotated eye retaining its original retina. Reversal of the localizing function in the nasal and temporal quadrants took place only when

the left (or right) eye was excised and grafted on the opposite side so that dorsal and ventral quadrants were normally oriented.

These and other experiments indicate that the localizing function of each retinal quadrant is determined by its original position within the eye and is independent of artificial changes of the position of the eye within the orbit. The local signs of the regenerated retina are the same as those of the original retina which it replaces. Experiments are now under way to determine the exact developmental period at which the retinal quadrants become functionally established ("functionally polarized"). A 400 foot (122 meter) motion picture has been made recording these experiments. P. C. KRONFELD.

BACKFLOW PHENOMENA IN AQUEOUS VEINS OF NORMAL AND OF GLAUCOMATOUS EYES. K. W. ASCHER, Am. J. Ophth. **27:** 1074 (Oct.) 1944.

Compression exerted by means of a minute cotton applicator on the recipient vessel near its junction with the aqueous vein produces either of the following characteristic aspects: The blocked section of the vessel, including the colorless aqueous vein, becomes filled with red blood cells, or the section becomes clearer than it was before the compression started, even almost colorless. As this part of the vessel resembles a transparent glass rod surrounded by semitransparent, porcelain-like scleral tissue, the effect has been called the glass rod phenomenon, while the opposite aspect, the entrance of red blood cells into a previously clear vessel, is referred to as the negative glass rod phenomenon. The direction in which, after compression of a recipient vessel, red blood cells or clear fluid leaves or enters an aqueous vein depends on the anastomotic pathways available and on the relative pressure potentials in each of them. As soon as the free flow in a vessel section is blocked, the source under high pressure will get priority. Fluid entering the meshwork from the source under lower pressure will be repelled until a new equilibrium has been established. Eyes with primary compensated glaucoma do not show the positive glass rod phenomenon, and the negative glass rod phenomenon regularly encountered in glaucomatous eyes may be considered an early sign of decompression. W. ZENTMAYER.

Retina and Optic Nerve

PHOTOGRAPHS OF RETINAL DETACHMENT IN APHAKIA BEFORE AND AFTER OPERATION. E. ROSEN, Brit. J. Ophth. **28:** 554 (Nov.) 1944.

A woman aged 61 with a mild form of diabetes associated with rather severe hypertension underwent successful operation for cataract in both eyes. Five months after the operation on the left eye a large detachment of the retina involving the upper nasal field developed. A hole with a crescentic operculum was present. Several electrodes were inserted in the region of the hole. Two and one-half years later visual acuity was 20/25, and the field showed slight concentric contraction. Photographs of the fundus before and six weeks after the operation for the detachment are included.

W. ZENTMAYER.

RETINAL MICRO-ANEURYSMS AND PUNCTATE HAEMORRHAGES. A. J. BALLANTYNE and A. LOEWENSTEIN, Brit. J. Ophth. **28:** 593 (Dec.) 1944.

In several recent papers the authors have directed attention to the minute red dots occasionally associated with the retinopathy of diabetes and included with the so-called deep, punctate hemorrhages which form part of the ophthalmoscopic picture of that disorder. It can now be shown that many, if not most, of the so-called punctate hemorrhages characteristically associated with diabetic retinopathy are actually capillary aneurysms.

By examination of the unstained retina in bulk, as well as in vertical and flat serial sections, these bodies are seen to be compact collections of red blood corpuscles, globular, with an average diameter of 50 to 60 microns and enclosed in a wall of varying thickness. With few exceptions, they occur in the inner nuclear layer, in the course of the capillaries which link the deeper and the more superficial capillary plexuses of the retina.

They may be a source of hemorrhage by diapedesis or by rhexis, and many of them are seen to undergo a process of thrombosis and cicatrization. They represent a stage in the vicious circle in which changes in the capillary endothelium lead to stasis in the circulation, which, in turn, causes further vascular changes, especially on the venous side of the retinal circulation.

The article is well illustrated.

W. ZENTMAYER.

Trachoma

ON THE MORBIDITY OF TRACHOMA. A. DE ROTTH, Am. J. Ophth. **27:** 1279 (Nov.) 1944.

De Rotth gives the following summary:

"Only in communities in which members of families live under very crowded and poor hygienic conditions, can the real sick rate of trachoma be determined, because of the chance of repeated and massive contacts. The morbidity is 100 per cent in Egypt, 30 to 60 per cent in Japan, and was found to be 30 to 58 per cent in Hungary, 42.3 per cent in inclusion-positive trachoma families. Certain individuals and old persons have a relative immunity, but no race is

immune from trachoma. The main source of trachoma is the family, and in southeastern Europe the migratory laborer.

"General welfare and hygiene help in the fight, as is well known. But the most important weapon is the treatment. The disappearance of the inclusion bodies from the conjunctiva in a few days, when sulfanilamide is administered, makes us hope that the infectivity of the individual can be quickly suspended, and thus the danger he represents be eliminated for family and country."

W. S. REESE.

Uvea

GREEN SPOT IN THE FUNDUS OF THE EYE. J. L. PAVIA and R. LACHMAN, Arch. de oftal. de Buenos Aires **18:** 647 (Nov.) 1943.

The occurrence of this sign in the fundus is more frequent than is generally believed. Forty-seven cases have so far been reported, the last 3 of which are mentioned in this paper.

With ordinary light this spot appears as a light green or grayish green area. If the red-free filter is interposed in the Gullstrand ophthalmoscope, the spot is not seen (as only the retina is visualized), and in this way it is differentiated from a retinal pigment deposit or hemorrhage. The best way to observe the green spot is by using the red radiation at the extreme end of the spectrum (the "infra-red Ilfor B filter") or by employing retrotransillumination of the chorioretina obtained with the Oculus ophthalmoscope. The spots are located in the substratum of the choroid.

With the special illumination the green spot has diffuse muddy margins, which fade out gradually and do not stand out prominently from the rest of the fundus; the spot is of irregular thickness and shows indentations and areas of lesser density.

The green spot is differentiated from pigment deposits by the black, discrete appearance of the latter, from choroidal hemorrhages by their deep black color and irregular margins and from intervascular pigment in the choroid by the particular arrangement of the pigment.

The condition is hard to photograph. The technic is given. The authors report 3 cases in which the green spot was present, all of which were seen in patients with cardiovascular disease, 2 with hypertension.

H. F. CARRASQUILLO.

Therapeutics

PENICILLIN IN OPHTHALMOLOGY. J. G. MILNER, Brit. M. J. **2:** 175 (Aug. 5) 1944.

This report includes a series of cases studied by various observers. Penicillin was used in the strength of 500 units per cubic centimeter when given in the form of drops and of 100 units per gram when used in an ointment base of lanette wax and petrolatum. Penicillin will retain its potency in the drop solution for four hours and in the ointment base for six hours (in the conjunctival sac). The frequency of treatments was regulated according to the requirements of the patient. Frequent applications are not necessary. There are definite indications for its use in management of the following conditions: blepharitis, acute conjunctivitis, corneal ulcer, dacryocystitis, stye and ocular injuries and in postoperative routine. There are indications for chronic conjunctivitis, infected socket and involvement of other external structures with possible secondary infection.

The author states that it is difficult to assess the value of the drug in cases of injury, as experience is insufficient, nor can anything be said at present regarding its value in the prevention of recurrence of inflammation. Penicillin, being bacteriostatic and not bactericidal, will have little power to prevent recurrences unless it can be used more or less as a routine in intervals between exacerbations. It is important that all patients having facial burns with ocular involvement be given penicillin from the very beginning of treatment. The author believes that by following this procedure a number of ulcers due to exposure keratitis can be avoided.

The concentration of 100 Oxford units per gram of ointment is in contrast to that of 600 to 800 Oxford units per gram used by Florey and of more than 1,000 Oxford units in the ointment made by Dr. K. Meyer (von Sallmann, L., and Meyer, K.: Penetration of Penicillin into the Eye, ARCH. OPHTH. **31:** 1 [Jan.] 1944).

ARNOLD KNAPP.

Toxic Amblyopia

ACTION OF ANTIFREEZE ON THE VISUAL ORGAN. A. P. ASTAKHOVA, Vestnik oftal. **22:** 33, 1943.

Antifreeze is a mixture of 55 per cent of ethylene glycol and water. The alcohol has two carbon atoms; it is colorless, odorless, slightly sweet, easily diluted in water and liquid. A dose of 200 cc. is sufficient to cause death. Astakhova examined 30 patients, 13 of whom died within the first day after exposure because of paralysis of cardiovascular and motor centers. In 6 of these patients the retina was cyanotic. One patient had optic neuritis, with decrease of visual acuity to ability to count fingers and a central scotoma in each eye; another patient had pallor of the optic disks, and 5 had hyperemia of the retinal blood vessels. The action of the antifreeze on the eye can be explained by its content of methyl alcohol.

O. SITCHEVSKA.

Society Transactions

EDITED BY DR. W. L. BENEDICT

NEW YORK ACADEMY OF MEDICINE, SECTION OF OPHTHALMOLOGY

THOMAS H. JOHNSON, M.D., *Chairman*

WENDELL L. HUGHES, M.D., *Secretary*

Feb. 19, 1945

Traumatic Injuries of the Eyes in Soldiers. DR. BENJAMIN RONES and MRS. HELENOR WILDER, Washington, D. C.

The authors studied 399 eyes removed from soldiers because of injuries in training and combat and sent to the Army Institute of Pathology, Washington, D. C. This series consisted of 373 eyes with penetrating wounds and 26 eyes with contusion injuries. Although 57 eyes were found to contain metallic foreign bodies, it was noteworthy that only 3 showed siderosis bulbi. Examination of the enucleated globes revealed a wide variety of tissue injuries and of mechanisms of repair. The penetrating wounds resulted in prolapse and incarceration of all the intraocular structures, separately and in combinations. Intraocular hemorrhages constituted the commonest finding: They were seen in all the tissues, in various stages of resorption and organization. The most frequent single structural change was traumatic cataract. Inflammatory changes in various stages were common. Secondary glaucoma was the most frequent sequel of contusion injuries, while phthisis bulbi occurred more often after penetrating wounds. The absence of any case of sympathetic ophthalmia was worthy of emphasis.

DISCUSSION

DR. HAROLD HENRY JOY, Syracuse, N. Y.: As I recall, there were no cases of sympathetic ophthalmia in the American Army in World War I, and I believe none in the British Army.

DR. ARNOLD KNAPP: I should like to compliment Dr. Rones and Mrs. Wilder on this splendid piece of work. Only one thing strikes me as difficult in this investigation—that is, to decide on the principal injury in these severely damaged eyes which had to be enucleated and to determine the order in which the other changes occurred.

DR. ELBERT S. SHERMAN, Newark, N. J.: If I understood Dr. Rones correctly, siderosis bulbi was observed in only 3 of the 57 eyes with retained intraocular foreign bodies, most of them metallic.

He said nothing about the interval between the date of injury and the enucleation. As siderosis is seldom apparent clinically earlier than five months after the injury, there should have been, unless most of these eyes were enucleated early, more instances of siderosis.

DR. BENJAMIN RONES, Washington, D. C.: Dr. Joy is correct in stating that there were no cases of sympathetic ophthalmia in the United States Army or the British Army after World War I. That does not detract from the credit due American ophthalmologists in the present war, for it is known that results in civilian practice are not so good. Military surgeons obviously have more latitude than civilian surgeons about removing eyes, and their percentage of cases of sympathetic ophthalmia has been zero.

Dr. Knapp is correct: There is not a great deal we can do with this material, and it is difficult to know how far we dare go in drawing conclusions. We are trying to find out what we can do and what we cannot do. We can describe our pathologic findings. We cannot always depend on the clinical history that is given us, but we are trying by follow-up studies to get as much as we can from the field surgeons. We have been fortunate that until recently Colonel Vail was consultant in ophthalmology for the European theater, and he insisted that information concerning time intervals and descriptions of the injuries should accompany the specimens. Although our primary interest is in the pathologic findings, it is to our advantage to have as complete a clinical record as possible.

Concerning the question of siderosis, one must bear in mind that the majority of the 57 eyes were removed shortly after injury. In the next paper we shall present a more detailed study of intraocular foreign bodies. At present, I cannot give the interval between injury and enucleation for the eyes that were retained for any length of time. The majority of the eyes were taken out shortly after injury because they were so badly damaged that it was not worth attempting removal of the foreign body. We shall know later how many cases of siderosis occurred after late retention of foreign bodies.

Surgical Procedures on the Anophthalmic Orbit. CAPT. ARTHUR GERARD DE VOE (MC), U.S.N.R.

A review of the difficulties encountered in fitting artificial eyes revealed that depression of the upper lid and loss of the orbital fold are commonly encountered. Reasons for this occurrence were hypothesized, and methods of treatment were described.

Implantation of cartilage subperiosteally in the floor of the orbit can be employed in cases of depressed fracture of the floor. Dermal grafts to the upper lid are useful in obliterating the depression when no fracture is present.

Another common defect is flaccidity of the lower lid and loss of the inferior fornix. This can be remedied by construction of a new fornix, lined, if necessary, with mucous membrane from the lid. This procedure was illustrated with a motion picture.

DISCUSSION

DR. WENDELL L. HUGHES: For correction of the depressed upper lid, there has been developed in the United States Naval Hospital at Bethesda, Md., a prosthesis with a thickened ridge along its upper edge. I wonder whether Captain De Voe has had any experience with it. In cases in which there is a definite fracture of the floor of the orbit, the procedure that Captain De Voe mentioned, in which cartilage is placed in the floor of the orbit, closing the hole in the floor and adding tissue to the orbit, gives as satisfactory a result as can be obtained. I was much interested in the use of a mucous membrane graft when there is a shallow lower fornix. It is an excellent procedure, and one which I shall try in the near future. I should like to report the case of a girl of 18 years who had had an artificial eye ever since she was a youngster. The artificial eye did the thing which Captain De Voe showed in his moving pictures; that is, it slipped out over the lower lid. In this case the conjunctiva was of sufficient extent that it could be dissected free and redistributed, to form a fornix below. There is usually one place in the middle of the socket where the conjunctiva is firmly adherent to the underlying structures. After it is freed, double-armed sutures can be used to bring down and retain the fornix. There was sufficient conjunctiva in this case so that no additional tissue was needed.

Captain De Voe's comment on the use of a combination of skin and mucous membrane in the orbit is apropos. The two do not mix well.

In a case like that of Captain De Voe's in which he had difficulty in putting in the artificial eye, I think a flexible prosthesis would do nicely. A concavoconvex one can be cut from a rubber ball. It has an advantage over the flat prosthesis, which is prepared from rigid plastic material.

CAPT. ARTHUR GERARD DE VOE: I have tried using a thickened ridge along the upper edge of the prosthesis and have had no success; the device merely widens the eye and makes the sclera stand out, without improving the appearance.

Ocular Manifestations Due to Nutritional Deficiencies in Naval Personnel in the Southwest Pacific. ARTHUR A. KNAPP (MC), U.S.N.R.

The patients considered in this report were Naval personnel at battle stations for six to eighteen months. Canned food had been used almost exclusively, and deficiency in several essential elements, among them vitamins and minerals, was unavoidable.

Except for the chorioretinitis, each of the disease entities discussed—myopia; night blindness; vernal catarrh, or allergic conjunctivitis; haziness of the fundus oculi; pallor of the optic nerve, and retrobulbar neuritis—has been shown to have a dietary background, but the extent to which a deficient diet is an etiologic factor has not been thoroughly studied. It is possible that in these conditions the food intake does not account for the entire picture.

The subjects exhibiting vernal catarrh, chorioretinitis and disease of the optic nerve responded well and quickly to the new diet when undernourishment was the primary cause. They showed improvement within a few days. The progress of the myopic patients could not be followed over a sufficiently long period. Ample studies, however, already have been made to establish the need of proper nutrition in cases of myopia.

Common to all of these patients is the fact that, except for the ocular manifestations, they did not reveal any clinical signs or symptoms of nutritional deficiency in other parts of the body. The men all appeared healthy; that is, the systemic nutritional lack was in a latent state. The ocular signs were the sole revealing indications of the underlying metabolic disorder.

A similar situation prevailed in much of our research work with animals. Often the pathologic condition of the eyes was the only clinical clue to the deficiency status.

Actually, the diets served at the base hospital, situated in a fine food-producing country in the Southwest Pacific, were far superior to those received by the men at their battle stations. Particular attention was paid to the milk intake. A quart (1,000 cc.) was advised, to give the necessary gram of available calcium. In addition, the diets frequently were fortified with vitamins A, B, C and D. The vitamin D intake especially was stressed, for lack of it, apparently, may give rise to many and diverse pathologic changes in the eyes.

Certain ocular changes were demonstrated in these patients with a faulty food intake—axial myopia; vernal catarrh, or allergic conjunctivitis; a slightly hazy fundus oculi, and disease of the optic nerve. These several signs of ocular disease in this series further corroborate the results of earlier research on animals and human subjects.

Evidently, a lack of vitamin D and/or calcium is a potent cause of disease of the eyes.

It is recommended that, aside from any other therapy, comparatively large doses of vitamin D and calcium be prescribed in all cases of progressive axial myopia, vernal catarrh and night blindness.

DISCUSSION

DR. GILBERT DALLDORF, Valhalla, N. Y.: Dr. Knapp's work is stimulating, original and highly

commendable, particularly since he found an effective method of treating what must have been a common disorder. It would be pretentious of me to comment on the way in which his report fits into knowledge of diseases of the eye. I can comment on how it is correlated with what is known of nutrition. It is obvious that Dr. Knapp takes into consideration these principles, for he has qualified the significance of the diet in deficiency diseases. It is recognized that nutritional deficiency does not necessarily mean a deficient diet, that symptoms and lesions due to deficiency can develop with a diet which is adequate for the average man. There is nothing mysterious about that. A man with bacillary dysentery who has an average fluid intake will become dehydrated, and a man in an advanced stage of cancer will become cachectic even though he is getting a normal diet. In both cases the patient becomes deficient in vitamins as well as dehydrated or cachectic. In these cases the explanation is relatively simple; in others it is complicated. The service men Dr. Knapp spoke of presumably were receiving a different diet while in combat, an emergency ration which, it may be assumed, was adequate in vitamins and minerals. But they were placed on it rather suddenly, and at the same time they were exposed to a different environment and to the stresses of warfare. Such conditions may influence the relative adequacy of the diet.

Little is known about the adult's requirement of vitamin D. Hepatic disease, the ingestion of certain metals, the acid-base nature of the diet and the vitamin E content, all influence the requirements of vitamin D. Perhaps climate does, also. I recall a study by Dr. Mills in which rats adapted to a high humidity and temperature—to tropical conditions—were found to require twice as much vitamin K as before.

The suddenness of change in diet may upset nutritional balances. It seems probable that man, like many other animals, can adapt to different levels of nutrition if given time. This is a lively subject in vitamin nutrition, which in some ways goes back twenty years to the observation that rats given a thiamine-deficient diet occasionally are able to adapt to the deficiency. Certain animals fared well, while their mates wasted away and died. The phenomenon was called refection. It is now known that some men can do the same thing. They synthesize the thiamine they need. This is dependent on the proper bacterial flora, which depends, also, on other factors in the diet which encourage the thiamine-synthesizing flora.

Environment is of considerable importance in nutrition. The importance of organic disease and of functional disturbances is greater. Most of the cases of deficiency disease occurring in North America are secondary to some other condition. I suspect that something of this kind operated among Dr. Knapp's patients. Secondary lesions in deficiency states respond to vitamin therapy, but they are cured only by correction of the underlying cause. In how many cases the underlying cause was corrected by bringing these service men back to a base hospital one does not know.

May I add one other observation? The reason that one must speculate about these things and the reason that Dr. Knapp cannot be certain of the part which vitamin D played in the ocular lesions he noted is simply that objective, reliable criteria for minor degrees of vitamin deficiency do not exist. Nutritionists have failed to develop means of identifying these conditions. Ophthalmologists have contributed some of the best tests, such as the estimation of regeneration of visual purple, and I hope that they will devise others. Dr. Knapp's results suggest that this may occur.

COLLEGE OF PHYSICIANS, PHILADELPHIA, SECTION ON OPHTHALMOLOGY

WARREN S. REESE, M.D., *Chairman*

GEORGE F. J. KELLY, M.D., *Clerk*

March 15, 1945

Traumatic Iridodialysis: Its Surgical Correction, with Report of a Case. DR. A. BARLOW and DR. HERMAN L. WEINER (by invitation).

This paper will be published in full, with discussion, in a future issue of the ARCHIVES.

Symmetric Defects of the Lower Lids Associated with Abnormalities of the Zygomatic Processes of the Temporal Bones. DR. IRVING H. LEOPOLD and (by invitation) DR. FRANCIS MAHONEY and MISS MABEL L. PRICE.

This paper will be published in full, with discussion, in a future issue of the ARCHIVES.

Intravitreal Penetration of Penicillin and Penicillin Therapy of Infections of the Vitreous. DR. IRVING H. LEOPOLD.

This paper was published in the March 1945 issue of the ARCHIVES, page 211.

DISCUSSION

DR. W. ZENTMAYER: Rycroft recently reported the results obtained with penicillin by the ophthalmologists in the British North African and Central Mediterranean forces (*Brit. J. Ophth.* **29**: 57 [Feb.] 1945). The study is largely clinical, and this may explain the apparent disagreement between their results and those reported by Dr. Leopold. They found that penicillin does not enter the ocular media when given intramuscularly. Such a method of administration does not influence the course of deep infections of the eye.

The eye will tolerate large concentrations of penicillin when injected into the media, but such concentrations do not control deep infections.

DR. H. MAXWELL LANGDON: The organism with which these experiments were carried out was selected especially for its lack of resistance to penicillin. It would be interesting to know the effect on other organisms in the vitreous. The organisms resistant to penicillin, of course, have been fairly well recognized and classified, but, as I understand it, some are more readily affected than others. Without cultures, of course, these less resistant organisms cannot be identified; so in the ordinary clinical case therapy is bound to be a trial and error procedure.

DR. IRVING H. LEOPOLD: I want to thank Dr. Zentmayer and Dr. Langdon for their discussions.

I, too, found Colonel Rycroft's excellent article discouraging. In all of his cases of inflammation of the vitreous the condition was due to intravitreal penetration of a foreign body. In only 2 was there improvement, and in these cases the offending foreign body was removed. In no case did cultures of the aqueous or the vitreous reveal that the exciting inflammatory agent was a penicillin-sensitive organism.

In all of Rycroft's cases intravitreal injections of penicillin were not made until the inflammatory process had become well established. In the experiments on rabbit eyes, therapy was instituted two hours after inoculation of the vitreous with Staphylococcus aureus. Studies by von Sallmann, Meyer and Di Grandi (Experimental Study on Penicillin Treatment of Ectogenous Infection of Vitreous, ARCH. OPHTH. **32**: 179 [Sept.] 1944) indicate that little can be expected from direct intravitreal injection of penicillin later than twelve hours after inoculation with the penicillin-sensitive organism, but that excellent results may be obtained with earlier institution of therapy.

Rycroft's studies on human eyes showed, as did the experiments on rabbit eyes, that intramuscularly administered penicillin did not produce detectable levels of the drug in the vitreous of normal eyes. He could not detect penicillin in the vitreous of inflamed human eyes after intramuscular administration, whereas the vitreous of inflamed rabbit eyes did possess detectable but inadequate concentrations of penicillin.

It is known that the permeability of capillaries in the rabbit eye is greater than that of capillaries in the human eye in inflammatory states. For example, Brown and Nantz (*Am. J. Ophth.* **27**: 1220, 1944) pointed out that the rabbit's secondary aqueous contains considerable fibrin, whereas the secondary aqueous of the adult human eye shows little, if any, fibrin. This difference in permeability must be kept in mind in drawing analogies between the data accumulated by experiments on rabbit eyes and those derived from studies on human eyes.

Staph. aureus was used in these studies because it was extremely sensitive to penicillin. The main purpose of the experiment was to compare the possible chances of controlling infections of the vitreous by the various methods of administration. I believe that the experimental data have shown the inadequacy of systemic therapy. Rycroft's experience would bear this out. The experimental studies indicate that direct intravitreal injections may be effective if one treats the infection early enough. The latter observation can be said to apply only when the infection of the vitreous is due to a penicillin-sensitive organism.

I agree with Dr. Langdon that these experiments are only an introduction to the problem of treating infection of the vitreous and that much more laboratory and clinical work will be necessary before the ideal method of treating infections of the vitreous with penicillin is known.

Reevaluation of the Herbert Operation for Glaucoma. DR. LOUIS LEHRFELD.

This paper will be published in full in a future issue of the ARCHIVES.

Obituaries

JOSEPH IMRE, M.D.
1884-1945

Imre was born of a long line of outstanding Protestant scholars, at Hódmezövásárhely, Hungary, on June 9, 1884. His father was in general practice and was later professor of ophthalmology at the University of Kolozsvár (Cluj), which position he had to leave when, at the end of World War I, Rumania took over Transylvania. After receiving his doctor's diploma at the University of Budapest, young Imre became assistant at the eye clinic of Prof. E. von Grósz. In 1911-1912 he spent a year at the Axenfeld clinic, in Freiburg, Germany; and in 1914 he became associate professor at his alma mater. As head of the department of ophthalmology of a military hospital during World War I, he had ample opportunity to do plastic operations. His artistic sense combined with surgical skill and imaginative power led to the perfection of the sliding flap technic in the reconstruction of defects of the lid, a method he inaugurated before 1914. The unequaled results of his plastic operations were published in several articles, as well as in an atlas (1930), and were reported in a paper delivered at the meeting of the Ophthalmological Society of the United Kingdom in 1937. In 1918 he was appointed professor at the Hungarian University of Pozsony, but the next year he had to leave his chair because this city (Bratislava) became part of Czechoslovakia. Imre faithfully followed the medical school on its odyssey to Budapest and finally to Pécs, in 1924. There he found an excellent atmosphere, and in the quietness of this small town, he and his assistants spent five years devoted to study and research. He was the first to point out the frequency of endocrine disturbances in patients with glaucoma and advocated the use of glandular preparations. Another of his original ideas was the discovery that microscopically thin, electrically distributed metal layers can be used as filters for certain visible and invisible rays, and he had such glasses constructed.

But surgery was his favorite subject. As early as 1918 he systematically used the intracapsular extraction of cataract. In 1925 he performed this operation in nearly 50 per cent of cases and also removed the capsule afterward when it was torn.

In 1928-1929 he became rector of the University of Pécs and in 1929 head of the state ophthalmologic hospital in Budapest. In the following years he was chiefly interested in the perfection of corneal transplantation and of the operation for retinal detachment. On the latter subject he read a paper before the Chicago Ophthalmological Society. He also modernized a textbook of ophthalmology. The one hundred and eighty bed hospital and a large practice would have been a real burden to anybody, but

JOSEPH IMRE, M.D.
1884-1945

Imre saw far beyond the limits of his profession; as the representative of Hungarian ophthalmology abroad, as a founder and regional chairman of the Rotary Association and with friends all over the world, it was his duty, he felt, to call attention to the problems and tragedy of his country.

In 1939 Imre was appointed head of the eye clinic of the University of Budapest. The Nazi-minded professors made his life bitter because of his international connections and liberal political views. Even his passport was taken away so that he could not leave the country.

The shortsighted policy of its leaders swept Hungary gradually closer to Nazism, away from the Anglo-Saxon democratic world, which Imre loved so much. He saw the impending tragedy to his country. His patriotic heart first broke in the fall of 1941 and stopped beating when the final collapse came, in January 1945.

A fascinating teacher and a most stimulating guide to his assistants, Imre was a charming man in social life, an enthusiast in regard to betterment of the world, a violinist and an artist, as so many great physicians are.

He is survived by his widow; a son, who is a physician, and a married daughter. Hungary has lost one of the very few men who had the talent, education, liberal ideals and international connections—in a word, the qualities—which could have made him a well qualified leader in this dire hour of his country.

ANDREW DE ROETTH.

News and Notes

EDITED BY DR. W. L. BENEDICT

GENERAL NEWS

Summer Graduate Course in Ophthalmology, University of Rochester School of Medicine and Dentistry.—The thirteenth summer graduate course in ophthalmology of the University of Rochester School of Medicine and Dentistry, Rochester, N. Y., will be held July 30 to Aug. 2, 1945.

The following lectures have been announced:

Monday, July 30: "Cataract Surgery," Dr. D. B. Kirby; "Toxoplasmosis" and "Recent Advances in Orbital Roentgenography," Dr. Raymond L. Pfeiffer, and "Ophthalmic Lenses," Mr. Scott Sterling. In the evening there will be a symposium on "Industrial Ophthalmology," conducted by Dr. A. C. Snell, Dr. Joseph Tiffin and Dr. A. Snell Jr.

Tuesday, July 31: "Visual Field Changes Produced by Intracranial Lesions" and "Vascular Affections of the Eyes and Cerebral Visual Structures," Dr. Donald J. Lyle; "Medical Ophthalmology" and "Surgical Treatment of Strabismus," Dr. Glen G. Gibson, and "Physiological Optics in Refraction," Mr. Fred Jobe.

Wednesday, August 1: "Treatment of Glaucoma," Dr. Paul A. Chandler; "Surgical Pathology of Glaucoma and Cataract" and "Malignant Melanoma and Other Conditions Which May Produce Glaucoma," Dr. T. L. Terry, and "Everyday Spectacle Problems," Mr. Irving Lueck.

Thursday morning, August 2, will be devoted to the surgical clinic at the Strong Memorial Hospital.

Applications for registration should be mailed to Dr. John F. Gipner, Strong Memorial Hospital, Rochester 7, N. Y. The tuition charge for the course will be $40.

Annual de Schweinitz Lecture.—Col. Derrick T. Vail will deliver the annual de Schweinitz Lecture before the College of Physicians, Philadelphia, Section on Ophthalmology, on Nov. 15, 1945.

UNIVERSITY NEWS

Honorary Degree Awarded to Dr. Hermann M. Burian by Colby College.—On June 3, 1945, Colby College, Waterville, Maine, awarded the honorary degree of Doctor of Science to Hermann M. Burian, M.D., ophthalmologist in chief, Dartmouth Eye Institute, Hanover, N. H. The citation of Colby College read as follows:

Hermann Martin Burian, son of a well-known professor of physiology, student of languages, literature, and music, as well as science, educated in the most renowned laboratories of the old world, you have won a distinguished place in the new. In the field of ocular motility and binocular vision your work has received the praise of those of your colleagues whose judgment is most to be esteemed and you are already hailed as one of the builders of American ophthalmology.

University of Oregon Medical School.—Dr. Frederick A. Kiehle has resigned as professor and head of the department of ophthalmology, after many years of distinguished service to the university of Oregon medical school. Dr. Kiehle has been appointed professor emeritus, and Dr. Kenneth C. Swan has been appointed professor and head of the department of ophthalmology.

Directory of Ophthalmologic Societies *

INTERNATIONAL

International Association for Prevention of Blindness

President: Dr. P. Bailliart, 66 Boulevard Saint-Michel, Paris, 6e, France.
Secretary-General: Prof. M. Van Duyse, Université de Gand, Gand, Prov. Ostflandern, Belgium.
All correspondence should be addressed to the Secretariat, 66 Boulevard Saint-Michel, Paris, 6e, France.

International Ophthalmologic Congress

President: Prof. Nordenson, Serafimerlasarettet, Stockholm, Sweden.
Secretary: Dr. Ehlers, Jerbanenegade 41, Copenhagen, Denmark.

International Organization Against Trachoma

President: Dr. A. F. MacCallan, 17 Horseferry Rd., London, England.

Pan-American Congress of Ophthalmology

President: Dr. Harry S. Gradle, 58 E. Washington St., Chicago.
Executive Secretaries: Dr. Conrad Berens, 35 E. 70th St., New York. Dr. M. E. Alvaro, 1511 Rua Consolacão, São Paulo, Brazil.

FOREIGN

All-India Ophthalmological Society

President: Dr. B. K. Narayan Rao, Minto Ophthalmic Hospital, Bangalore.
Secretary: Dr. G. Zachariah, Flitcham, Marshall's Rd., Madras.

British Medical Association, Section on Ophthalmology

President: Dr. W. Clark Souter, 9 Albyn Pl., Aberdeen, Scotland.
Secretary: Dr. Frederick Ridley, 12 Wimpole St., London, W. 1.

Chengtu Ophthalmological Society

President: Dr. Eugene Chan.
Secretary: Dr. K. S. Sun.
Place: Eye, Ear, Nose and Throat Hospital, Chengtu, China.

Chinese Ophthalmology Society

President: Dr. C. H. Chou, 363 Avenue Haig, Shanghai.
Secretary: Dr. F. S. Tsang, 221 Foochow Rd., Shanghai.

Chinese Ophthalmological Society of Peiping

President: Dr. H. T. Pi, Peiping Union Medical College, Peiping.
Secretary: Dr. C. K. Lin, 180 Hsi-Lo-yen Chienmeng, Peiping.
Place: Peiping Union Medical College, Peiping. Time: Last Friday of each month.

Faculty of Ophthalmologists

President: Brig. Sir Stewart Duke-Elder, 63 Harley St., London, W. 1, England.
Secretary: Mr. Frank W. Law, 45 Lincoln's Inn Fields, London, W. C. 2., England.

German Ophthalmological Society

President: Prof. W. Lohlein, Berlin.
Secretary: Prof. E. Engelking, Heidelberg.

Hungarian Ophthalmological Society

President: Prof. I. Imre, Budapest.
Assistant Secretary: Dr. Stephen de Grósz, University Eye Hospital, Máriautca 39, Budapest.
All correspondence should be addressed to the Assistant Secretary.

Midland Ophthalmological Society

President: Dr. W. Niccol, 4 College Green, Gloucester, England.
Secretary: Mr. T. Harrison Butler, 61 Newhall St., Birmingham 3, England.
Place: Birmingham and Midland Eye Hospital.

North of England Ophthalmological Society

President: Mr. John Foster, 45 Park Sq., Leeds.
Secretary: Mr. William M. Muirhead, 70 Upper Hanover St., Sheffield.
Place: Manchester, Bradford, Leeds, Newcastle-upon-Tyne, Liverpool and Sheffield, in rotation. Time: October to April.

Ophthalmological Society of Australia

President: Dr. A. James Flynn, 135 Macquarie St., Sydney.
Secretary: Dr. D. Williams, 193 Macquarie St., Sydney.

Ophthalmological Society of Egypt

President: Prof. Dr. Mohammed Mahfouz Bey, Government Hospital, Alexandria.
Secretary: Dr. Mohammed Khalil, 4 Baehler St., Cairo.
All correspondence should be addressed to the secretary, Dr. Mohammed Khalil.

Ophthalmological Society of South Africa

President: Dr. A. W. Sichel, National Mutual Bldg., Church Square, Cape Town.
Secretary: Dr. J. K. de Kock, Groote Kerk Bldg., 32 Parliament St., Cape Town.

Ophthalmological Society of the United Kingdom

President: Mr. Charles B. Goulden, 89 Harley St., London.
Secretary: Mr. Frank W. Law, 30 Devonshire Pl., London, W. 1.

Ophthalmology Society of Bombay

President: Dr. D. D. Sathaye, 127 Girgaum Rd., Bombay 4, India.
Secretary: Dr. H. D. Dastur, Dadar, Bombay 14, India.
Place: H. B. A. Free Ophthalmic Hospital, Parel, Bombay 12. Time: First Friday of every month.

Oxford Ophthalmological Congress

Master: Mr. P. G. Doyne, 60 Queen Anne St., London, W. 1, England.
Secretary-Treasurer: Dr. F. A. Anderson, 12 St. John's Hill, Shrewsbury, England.

Palestine Ophthalmological Society

President: Dr. Arieh Feigenbaum, Abyssinian St. 15, Jerusalem.
Secretary: Dr. E. Sinai, Tel Aviv.

* Secretaries of societies are requested to furnish the information necessary to make this list complete and keep it up to date.

POLISH OPHTHALMOLOGICAL SOCIETY

President: Dr. W. Kapuściński, 2 Waly Batorego, Poznań.
Secretary: Dr. J. Sobański, Lindley'a 4, Warsaw.
Place: Lindley'a 4, Warsaw.

ROYAL SOCIETY OF MEDICINE, SECTION OF OPHTHALMOLOGY

President: Col. F. A. Juler, 96 Harley St., London, W. 1, England.
Secretary: Dr. Harold Ridley, 60 Queen Anne St., London, W. 1, England.

SÃO PAULO SOCIETY OF OPHTHALMOLOGY

President: Prof. Moacyr E. Alvaro, Consolação 1151, São Paulo, Brazil.
Secretary: Dr. Silvio de Almeida Toledo, Enfermaria Santo Luzia, Santa Casa de Misericordia, Cesario Motta, St. 112, São Paulo, Brazil.

SCOTTISH OPHTHALMOLOGICAL CLUB

President: Dr. S. Spence Meighan, 13 Woodside Pl., Glasgow, C. 3.
Secretary: Dr. Alexander Garrow, 15 Woodside Pl., Glasgow, C. 3.
Place: Edinburgh and Glasgow, in rotation.

SOCIEDAD ARGENTINA DE OFTALMOLOGIA

Chairman: Dr. Jorge Malbrán, Buenos Aires.
Secretary: Dr. Benito Just Tiscornia, Santa Fe 1171, Buenos Aires.

SOCIEDAD OFTALMOLOGIA DEL LITORAL, ROSARIO (ARGENTINA)

President: Prof. Dr. Carlos Weskamp, Laprida 1159, Rosario.
Secretary: Dr. Arturo Etchemendigaray, Villa Constitución, Santa Fé.
Place: Rosario. Time: Last Saturday of every month, April to November. All correspondence should be addressed to the President.

SOCIEDADE DE OFTALMOLOGIA DE MINAS GERAIS

President: Prof. Hilton Rocha, Rua Rio de Janeiro 2251, Bello Horizonte, Minas Geraes, Brazil.
Secretary: Dr. Ennio Coscarelli, Rua Aimorés 1697, Bello Horizonte, Minas Geraes, Brazil.

SOCIEDADE DE OFTALMOLOGIA E OTORRINOLARINGOLOGIA DE RIO GRANDE DO SUL

President: Dr. Luiz Assumpção Osorio, Edificio Vera Cruz, Apartamento 134, Porto Alegre, Rio Grande do Sul.
Secretary: Dr. Fernando Voges Alves, Caixa Postal 928, Porto Alegre, Rio Grande do Sul.

SOCIEDADE DE OPHTHALMOLOGIA E OTO-RHINO-LARYNGOLOGIA DA BAHIA

President: Dr. Theonilo Amorim, Barra Avenida, Bahia, Brazil.
Secretary: Dr. Adroaldo de Alencar, Brazil.
All correspondence should be addressed to the President.

SOCIETÀ OFTALMOLOGICA ITALIANA

President: Prof. Dott. Giuseppe Ovio, Ophthalmological Clinic, University of Rome, Rome.
Secretary: Prof. Dott. Epimaco Leonardi, Via del Gianicolo, 1, Rome.

SOCIÉTÉ FRANÇAISE D'OPHTALMOLOGIE

Secretary: Dr. René Onfray, 6 Avenue de la Motte Picquet, Paris, 7e.

SOCIETY OF SWEDISH OPHTHALMOLOGISTS

President: Prof. K. G. Ploman, Stockholm.
Secretary: Dr. K. O. Granström, Södermalmstorg 4 Ill tr., Stockholm, Sö.

TEL AVIV OPHTHALMOLOGICAL SOCIETY

President: Dr. D. Arieh-Friedman, 96 Allenby St., Tel Aviv, Palestine.
Secretary: Dr. Sadger Max, 9 Bialik St., Tel Aviv, Palestine.

NATIONAL

AMERICAN MEDICAL ASSOCIATION, SCIENTIFIC ASSEMBLY, SECTION ON OPHTHALMOLOGY

Chairman: Dr. Frederick C. Cordes, 384 Post St., San Francisco.
Secretary: Dr. R. J. Masters, 23 E. Ohio St., Indianapolis.
In compliance with the request of the Office of Defense Transportation and in the interest of the national war effort a meeting will not be held in 1945.

AMERICAN ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY, SECTION ON OPHTHALMOLOGY

President: Dr. Gordon B. New, Mayo Clinic, Rochester, Minn.
President-Elect: Dr. Alan C. Woods, Johns Hopkins Hospital, Baltimore 5.
Executive Secretary-Treasurer: Dr. William L. Benedict, 100–1st Ave. Bldg., Rochester, Minn.

AMERICAN OPHTHALMOLOGICAL SOCIETY

President: Dr. S. Judd Beach, 704 Congress St., Portland, Maine.
Secretary-Treasurer: Dr. Walter S. Atkinson, 129 Clinton St., Watertown, N. Y.

ASSOCIATION FOR RESEARCH IN OPHTHALMOLOGY, INC.

Chairman: Dr. Conrad Berens, 35 E. 70th St., New York.
Secretary-Treasurer: Major Brittain F. Payne, School of Aviation Medicine, Randolph Field, Texas.
Assistant Secretary-Treasurer: Dr. Hunter Romaine, 35 E. 70th St., New York.

CANADIAN MEDICAL ASSOCIATION, SECTION ON OPHTHALMOLOGY

President: Dr. Alexander E. MacDonald, 170 St. George St., Toronto.
Secretary-Treasurer: Dr. L. J. Sebert, 170 St. George St., Toronto.

CANADIAN OPHTHALMOLOGICAL SOCIETY

President: Dr. R. Evatt Mathers, 34½ Morris St., Halifax, N. S.
Secretary-Treasurer: Dr. Kenneth B. Johnston, Suite 1, 1509 Sherbrooke St. W., Montreal.

NATIONAL SOCIETY FOR THE PREVENTION OF BLINDNESS

President: Mr. Mason H. Bigelow, 1790 Broadway, New York.
Secretary: Miss Regina E. Schneider, 1790 Broadway, New York.
Executive Director: Mrs. Eleanor Brown Merrill, 1790 Broadway, New York.

SECTIONAL

Academy of Medicine of Northern New Jersey, Section on Eye, Ear, Nose and Throat

President: Dr. N. Zwaifler, 46 Wilbur Ave., Newark.
Secretary: Dr. William F. Keim Jr., 25 Roseville Ave., Newark.
Place: 91 Lincoln Park South, Newark. Time: 8:45 p. m., second Monday of each month, October to May.

Central Illinois Society of Ophthalmology and Otolaryngology

President: Dr. Watson Gailey, 1000 N. Main St., Bloomington, Ill.
Secretary-Treasurer: Dr. William F. Hubble, 861-867 Citizens Bldg., Decatur, Ill.

Central Wisconsin Society of Ophthalmology and Otolaryngology

President: Dr. L. J. Friend, 425 E. Grand Ave., Beloit, Wis.
Secretary: Dr. G. L. McCormick, 626 S. Central Ave., Marshfield.

New England Ophthalmological Society

President: Dr. Theodore L. Terry, 140 Marlborough St., Boston.
Secretary-Treasurer: Dr. Merrill J. King, 264 Beacon St., Boston.
Place: Massachusetts Eye and Ear Infirmary, 243 Charles St., Boston. Time: 8 p. m., third Tuesday of each month from November to April, inclusive.

Pacific Coast Oto-Ophthalmological Society

President: Dr. D. H. O'Rourke, 1612 Tremont Pl., Denver.
Secretary-Treasurer: Dr. C. Allen Dickey, 450 Sutter St., San Francisco.

Puget Sound Academy of Ophthalmology and Oto-Laryngology

President: Dr. James H. Mathews, 1317 Marion St., Seattle, Wash.
Secretary-Treasurer: Dr. Barton E. Peden, 301 Stimson Bldg., Seattle 1.
Place: Seattle or Tacoma, Wash. Time: Third Tuesday of each month except June, July and August.

Rock River Valley Eye, Ear, Nose and Throat Society

President: Dr. J. Sheldon Clark, 27 E. Stephenson St., Freeport, Ill.
Secretary-Treasurer: Dr. Harry R. Warner, 321 W. State St., Rockford, Ill.
Place: Rockford, Ill., or Janesville or Beloit, Wis. Time: Third Tuesday of each month from October to April, inclusive.

Saginaw Valley Academy of Ophthalmology and Otolaryngology

President: Dr. L. D. Gomon, 308 Eddy Bldg., Saginaw, Mich.
Secretary-Treasurer: Dr. Harold H. Heuser, 207 Davidson Bldg., Bay City, Mich.
Place: Saginaw or Bay City, Mich. Time: Second Tuesday of each month, except July, August and September.

Sioux Valley Eye and Ear Academy

President: Dr. J. C. Decker, 515 Francis Bldg., Sioux City, Iowa.
Secretary-Treasurer: Dr. J. E. Dvorak, 408 Davidson Bldg., Sioux City, Iowa.

Southern Medical Association, Section on Eye, Ear, Nose and Throat

Chairman: Dr. John H. Burleson, 414 Navarro St., San Antonio, Texas.
Secretary: Dr. J. W. Jervey Jr., 101 Church St., Greenville, S. C.

Southwestern Academy of Eye, Ear, Nose and Throat

President: Dr. H. L. Brehmer, 221 W. Central Ave., Albuquerque, N. Mex.
Secretary: Dr. A. E. Cruthirds, 1011 Professional Bldg., Phoenix, Ariz.

Southwestern Michigan Triological Society

President: Dr. W. M. Dodge, 716 First National Bank Bldg., Battle Creek.
Secretary-Treasurer: Dr. Kenneth Lowe, 25 W. Michigan Ave., Battle Creek.
Time: Last Thursday of September, October, November, March, April and May.

Western Pennsylvania Eye, Ear, Nose and Throat Society

President: Dr. Ray Parker, 218 Franklin St., Johnston, Pa.
Secretary-Treasurer: Dr. J. McClure Tyson, Deposit Nat'l Bank Bldg., DuBois.

STATE

Arkansas State Medical Society, Eye, Ear, Nose and Throat Section

President: Dr. Raymond C. Cook, 701 Main St., Little Rock.
Secretary: Dr. K. W. Cosgrove, Urquhart Bldg., Little Rock.

Colorado Ophthalmological Society

President: Dr. C. A. Ringle, 912–9th Ave., Greeley.
Secretary: Dr. W. A. Ohmart, 1102 Republic Bldg., Denver.
Place: University Club, Denver. Time: 7:30 p. m., third Saturday of each month, October to May, inclusive.

Connecticut State Medical Society, Section on Eye, Ear, Nose and Throat

President: Dr. F. L. Phillips, 405 Temple St., New Haven.
Secretary-Treasurer: Dr. W. H. Turnley, 1 Atlantic St., Stamford, Conn.

Eye, Ear, Nose and Throat Club of Georgia

President: William O. Martin Jr., Doctors Bldg., Atlanta.
Secretary-Treasurer: Dr. C. K. McLaughlin, 526 Walton St., Macon.

Indiana Academy of Ophthalmology and Oto-Laryngology

President: Dr. F. McK. Ruby, Union City.
Secretary: Dr. Edwin W. Dyar Jr., 23 E. Ohio St., Indianapolis.
Place: French Lick. Time: First Wednesday in April.

Iowa Academy of Ophthalmology and Oto-Laryngology

President: Dr. J. K. Von Lackum, 117–3d St. S. E., Cedar Rapids.
Secretary-Treasurer: Dr. B. M. Merkel, 604 Locust St., Des Moines.

Kansas State Medical Society, Section on Ophthalmology and Otolaryngology

President: Dr. W. D. Pittman, Pratt.
Secretary: Dr. Louis R. Haas, 902 N. Broadway, Pittsburg.

Louisiana-Mississippi Ophthalmological and Otolaryngological Society

President: Dr. Val. H. Fuchs, 200 Carondelet St., New Orleans.
Secretary-Treasurer: Dr. Edley H. Jones, 1301 Washington St., Vicksburg, Miss.

Michigan State Medical Society, Section of Ophthalmology and Otolaryngology

Chairman: Dr. Robert H. Fraser, 25 W. Michigan Ave., Battle Creek.
Secretary: Dr. R. G. Laird, 114 Fulton St., Grand Rapids.

Minnesota Academy of Ophthalmology and Otolaryngology

President: Dr. George E. McGeary, 920 Medical Arts Bldg., Minneapolis.
Secretary: Dr. William A. Kennedy, 372 St. Peter St., St. Paul.
Time: Second Friday of each month from October to May.

Montana Academy of Oto-Ophthalmology

President: Dr. William Morrison, 208 N. Broadway, Billings.
Secretary: Dr. Fritz D. Hurd, 309 Medical Arts Bldg., Great Falls.

Nebraska Academy of Ophthalmology and Otolaryngology

President: Dr. W. Howard Morrison, 1500 Medical Arts Bldg., Omaha.
Secretary-Treasurer: Dr. John Peterson, 1307 N. St., Lincoln.

New Jersey State Medical Society, Section on Ophthalmology, Otology and Rhinolaryngology

Chairman: Dr. George P. Meyer, 410 Haddon Ave., Camden.
Secretary: Dr. John P. Brennan, 429 Cooper St., Camden.

New York State Medical Society, Eye, Ear, Nose and Throat Section

Chairman: Dr. Harold J. Joy, 504 State Tower Bldg., Syracuse 2.
Secretary: Dr. Maxwell D. Ryan, 660 Madison Ave., New York 21.

North Carolina Eye, Ear, Nose and Throat Society

President: Dr. Hugh C. Wolfe, 102 N. Elm St., Greensboro.
Secretary: Dr. Vanderbilt F. Couch, 104 W. 4th St., Winston-Salem.

North Dakota Academy of Ophthalmology and Oto-Laryngology

President: Dr. W. L. Diven, City National Bank Bldg., Bismarck.
Secretary-Treasurer: Dr. A. E. Spear, 20 W. Villard, Dickenson.

Oregon Academy of Ophthalmology and Oto-Laryngology

President: Dr. Paul Neely, 1020 S. W. Taylor St., Portland.
Secretary-Treasurer: Dr. Lewis Jordon, 1020 S. W. Taylor St., Portland.
Place: Good Samaritan Hospital, Portland. Time: Third Tuesday of each month.

Pennsylvania Academy of Ophthalmology and Otolaryngology

President: Dr. Lewis T. Buckman, 83 S. Franklin St., Wilkes-Barre.
Secretary Pro Tem: Dr. Paul C. Craig, 232 N. 5th St., Reading.
Time: Last week in April.

Rhode Island Ophthalmological and Otological Society

Acting President: Dr. N. Darrell Harvey, 112 Waterman St., Providence.
Secretary-Treasurer: Dr. Linley C. Happ, 124 Waterman St., Providence.
Place: Rhode Island Medical Society, Library, Providence. Time: 8:30 p. m., second Thursday in October, December, February and April.

South Carolina Society of Ophthalmology and Otolaryngology

President: Dr. J. L. Sanders, 222 N. Main St., Greenville.
Secretary: Dr. J. H. Stokes, 125 W. Cheves St., Florence.

Tennessee Academy of Ophthalmology and Otolaryngology

President: Dr. Wesley Wilkerson, 700 Church St., Nashville.
Secretary-Treasurer: Dr. W. D. Stinson, 124 Physicians and Surgeons Bldg., Memphis.

Texas Ophthalmological and Oto-Laryngological Society

President: Dr. F. H. Rosebrough, 603 Navarro St., San Antonio.
Secretary: Dr. M. K. McCullough, 1717 Pacific Ave., Dallas.

Utah Ophthalmological Society

President: Dr. R. B. Maw, 699 E. South Temple, Salt Lake City.
Secretary-Treasurer: Dr. Charles Ruggeri Jr., 1120 Boston Bldg., Salt Lake City.
Place: University Club, Salt Lake City. Time: 7:00 p. m., third Monday of each month.

Virginia Society of Oto-Laryngology and Ophthalmology

President: Dr. Mortimer H. Williams, 30½ Franklin Rd. S. W., Roanoke.
Secretary-Treasurer: Dr. Meade Edmunds, 34 Franklin St., Petersburg.

WEST VIRGINIA STATE MEDICAL ASSOCIATION, EYE, EAR, NOSE AND THROAT SECTION

President: Dr. George Traugh, 309 Cleveland Ave., Fairmont.

Secretary: Dr. Welch England, 621½ Market St., Parkersburg.

LOCAL

AKRON ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President: Dr. E. L. Mather, 39 S. Main St., Akron, Ohio.

Secretary-Treasurer: Dr. V. C. Malloy, 2d National Bank Bldg., Akron, Ohio.

Time: First Monday in January, March, May and November.

ATLANTA EYE, EAR, NOSE AND THROAT SOCIETY

President: Dr. B. M. Cline, 153 Peachtree St. N. E., Atlanta, Ga.

Acting Secretary: Dr. A. V. Hallum, 478 Peachtree St. N. E., Atlanta, Ga.

Place: Grady Hospital. Time: 6:00 p. m., fourth Monday of each month, from October to May.

BALTIMORE MEDICAL SOCIETY, SECTION ON OPHTHALMOLOGY

Chairman: Dr. Ernst Bodenheimer, 1212 Eutaw Pl., Baltimore.

Secretary: Dr. Thomas R. O'Rourk, 104 W. Madison St., Baltimore.

Place: Medical and Chirurgical Faculty, 1211 Cathedral St. Time: 8:30 p. m., fourth Thursday of each month from October to March.

BIRMINGHAM EYE, EAR, NOSE AND THROAT CLUB

President: Each member, in alphabetical order.

Secretary: Dr. Luther E. Wilson, 919 Woodward Bldg., Birmingham, Ala.

Place: Tutwiler Hotel. Time: 6:30 p. m., second Tuesday of each month, September to May, inclusive.

BROOKLYN OPHTHALMOLOGICAL SOCIETY

President: Dr. Michael J. Buonaguro, 589 Lorimer St., Brooklyn.

Secretary-Treasurer: Dr. Benjamin C. Rosenthal, 140 New York Ave., Brooklyn 16.

Place: Kings County Medical Society Bldg., 1313 Bedford Ave. Time: Third Thursday in February, April, May, October and December.

BUFFALO OPHTHALMOLOGIC CLUB

President: Dr. Walter F. King, 519 Delaware Ave., Buffalo.

Secretary-Treasurer: Dr. Sheldon B. Freeman, 196 Linwood Ave., Buffalo.

Time: Second Thursday of each month.

CHATTANOOGA SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President: Each member, in alphabetical order.

Secretary: Dr. Douglas Chamberlain, Chattanooga Bank Bldg., Chattanooga, Tenn.

Place: Mountain City Club. Time: Second Thursday of each month from September to May.

CHICAGO OPHTHALMOLOGICAL SOCIETY

President: Dr. Samuel J. Meyer, 58 E. Washington St., Chicago 2.

Secretary: Dr. W. A. Mann, 30 N. Michigan Ave., Chicago 2.

Place: Continental Hotel, 505 N. Michigan Ave. Time: Third Monday of each month from October to May.

CINCINNATI GENERAL HOSPITAL OPHTHALMOLOGY STAFF

Chairman: Dr. D. T. Vail, 441 Vine St., Cincinnati.

Secretary: Dr. A. A. Levin, 441 Vine St., Cincinnati.

Place: Cincinnati General Hospital. Time: 7:45 p. m., third Friday of each month except June, July and August.

CLEVELAND OPHTHALMOLOGICAL CLUB

Chairman: Dr. M. Paul Motto, Rose Bldg., Cleveland.

Secretary: Dr. H. H. Wygand, Guardian Bldg., Cleveland.

Time: Second Tuesday in October, December, February and April.

COLLEGE OF PHYSICIANS, PHILADELPHIA, SECTION ON OPHTHALMOLOGY

Chairman: Dr. W. S. Reese, 1901 Walnut St., Philadelphia.

Clerk: Dr. George F. J. Kelly, 37 S. 20th St., Philadelphia.

Time: Third Thursday of every month from October to April, inclusive.

COLUMBUS OPHTHALMOLOGICAL AND OTO-LARYNGOLOGICAL SOCIETY

Chairman: Dr. Erwin W. Troutman, 21 E. State St., Columbus, Ohio.

Secretary-Treasurer: Dr. T. Rees Williams, 380 E. Town St., Columbus 15, Ohio.

Place: University Club. Time: 6:15 p. m., first Monday of each month, from October to May, inclusive.

CORPUS CHRISTI EYE, EAR, NOSE AND THROAT SOCIETY

Chairman: Dr. C. B. Collins, 704 Medical Professional Bldg., Corpus Christi, Texas.

Secretary: Dr. L. W. O. Janssen, 710 Medical Professional Bldg., Corpus Christi, Texas.

Time: 6:30 p. m., third Tuesday of each month from October to May.

DALLAS ACADEMY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY

President: Dr. Ruby K. Daniel, Medical Arts Bldg., Dallas 1, Texas.

Secretary: Dr. Tom Barr, Medical Arts Bldg., Dallas 1, Texas.

Place: Dallas Athletic Club. Time: 6:30 p. m., first Tuesday of each month from October to June. The November, January and March meetings are devoted to clinical work.

Des Moines Academy of Ophthalmology and Otolaryngology

President: Dr. H. C. Schmitz, 604 Locust St., Des Moines, Iowa.

Secretary-Treasurer: Dr. Byron M. Merkel, 604 Locust St., Des Moines, Iowa.

Time: 7:45 p. m., third Monday of every month from September to May.

Detroit Ophthalmological Club

Chairman: Members rotate alphabetically.

Secretary: Dr. Cecil W. Lepard, 1025 David Whitney Bldg., Detroit 26.

Place: Club rooms of Wayne County Medical Society.

Time: First Wednesday of each month, November to April, inclusive.

Detroit Ophthalmological Society

President: Dr. Raymond S. Goux, 545 David Whitney Bldg., Detroit 26.

Secretary: Dr. Arthur Hale, 1609 Eaton Tower, Detroit 26.

Place: Club rooms of Wayne County Medical Society. Time: 6:30 p. m., third Thursday of each month from November to April, inclusive.

Eastern New York Eye, Ear, Nose and Throat Association

President: Appointed at each meeting.

Secretary-Treasurer: Dr. Joseph L. Holohan, 330 State St., Albany.

Time: Third Wednesday in October, November, March, April, May and June.

Fort Worth Eye, Ear, Nose and Throat Society

President: Dr. Rex Howard, 602 W. 10th St., Fort Worth, Texas.

Secretary-Treasurer: Dr. R. H. Gough, Medical Arts Bldg., Fort Worth, Texas.

Place: Medical Hall, Medical Arts Bldg. Time: 7:30 p. m., first Friday of each month except July and August.

Houston Academy of Medicine, Ophthalmological and Oto-Laryngological Section

President: Dr. Lyle J. Logue, 1304 Walker Ave., Houston, Texas.

Secretary: Dr. John T. Stough, 803 Medical Arts Bldg., Houston, Texas.

Place: Medical Arts Bldg., Harris County Medical Society Rooms. Time: 8 p. m., second Thursday of each month from September to June.

Indianapolis Ophthalmological and Oto-laryngological Society

President: Dr. Myron Harding, 23 E. Ohio St., Indianapolis.

Secretary: Dr. Kenneth L. Craft, 23 E. Ohio St., Indianapolis.

Place: Indianapolis Athletic Club. Time: 6:30 p. m., second Thursday of each month from November to May.

Kansas City Society of Ophthalmology and Oto-Laryngology

President: Dr. Edgar Johnson, 906 Grand Ave., Kansas City, Mo.

Secretary: Dr. W. E. Keith, 1103 Grand Ave., Kansas City, Mo.

Time: Third Thursday of each month from October to June. The November, January and March meetings are devoted to clinical work.

Long Beach Eye, Ear, Nose and Throat Society

Chairman: Dr. Dennis Smith, 623 Security Bldg., Long Beach 2, Calif.

Secretary-Treasurer: Dr. Robert Null, 710 Security Bldg., Long Beach 2, Calif.

Place: Seaside Hospital. Time: Last Wednesday of each month from October to May.

Los Angeles Society of Ophthalmology and Otolaryngology

President: Dr. Orrie E. Ghrist, 210 N. Central Ave., Glendale, Calif.

Secretary-Treasurer. Dr. K. C. Brandenburg, 110 Pine Ave., Long Beach 2, Calif.

Place: Los Angeles County Medical Association Bldg., 1925 Wilshire Blvd. Time: 6:00 p. m., fourth Monday of each month from September to May, inclusive.

Louisville Eye and Ear Society

President: Dr. Joseph S. Heitger, Heyburn Bldg., Louisville, Ky.

Secretary-Treasurer: Dr. J. W. Fish, 321 W. Broadway, Louisville, Ky.

Place: Brown Hotel. Time: 6:30 p. m., second Thursday of each month from September to May, inclusive.

Lower Anthracite Eye, Ear, Nose and Throat Society

Chairman: Each member in alphabetical order.

Secretary: Dr. James J. Monohan, 31 S. Jardin St., Shenandoah, Pa.

Medical Society of the District of Columbia, Section of Ophthalmology and Otolaryngology

Chairman: Dr. P. S. Constantinople, 1835 I St. N. W., Washington.

Secretary: Dr. Frazier Williams, 1801 I St. N. W., Washington.

Place: 1718 M St. N. W. Time: 8 p. m., third Friday of each month from October to April, inclusive.

Memphis Society of Ophthalmology and Otolaryngology

Chairman: Each member in alphabetical order.

Secretary: Dr. Sam H. Sanders, 1089 Madison Ave., Memphis, Tenn.

Place: Eye Clinic of Memphis Eye, Ear, Nose and Throat Hospital. Time: 8 p. m., second Tuesday of each month from September to May.

Milwaukee Oto-Ophthalmic Society

President: Dr. Ralph T. Rank, 238 W. Wisconsin Ave., Milwaukee.

Secretary-Treasurer: Dr. Frank G. Treskow, 411 E. Mason St., Milwaukee 2.

Place: University Club. Time: 6:30 p. m., fourth Tuesday of each month from October to May.

Montgomery County Medical Society

Chairman: Dr. H. V. Dutrow, 1040 Fidelity Medical Bldg., Dayton, Ohio.
Secretary-Treasurer: Dr. Maitland D. Place, 981 Reibold Bldg., Dayton, Ohio.
Place: Van Cleve Hotel. Time: 6:30 p. m., first Tuesday of each month from October to June, inclusive.

Montreal Ophthalmological Society

President: Dr. J. Rosenbaum, 1396 Ste. Catherine St. W., Montreal, Canada.
Secretary: Dr. L. Tessier, 1230 St. Joseph Blvd. E., Montreal, Canada.
Time: Second Thursday of October, December, February and April.

Nashville Academy of Ophthalmology and Otolaryngology

Chairman: Dr. M. M. Cullom, 700 Church St., Nashville, Tenn.
Secretary: Dr. R. E. Sullivan, 432 Doctors Bldg., Nashville, Tenn.
Place: St. Thomas Hospital. Time: 8 p. m., third Monday of each month from October to May.

New Haven Ophthalmological Society

President: Dr. William H. Ryder, 185 Church St., New Haven, Conn.
Secretary: Dr. Frederick A. Wiess, 255 Bradley St., New Haven, Conn.

New Orleans Ophthalmological and Oto-laryngological Society

President: Dr. W. B. Clark, 1012 American Bank Bldg., New Orleans.
Secretary: Dr. Mercer G. Lynch, 1018 Maison Blanche Bldg., New Orleans.
Place: Louisiana State University Medical Bldg. Time: 8 p. m., second Tuesday of each month from October to May.

New York Academy of Medicine, Section of Ophthalmology

Chairman: Dr. Thomas H. Johnson, 30 W. 59th St., New York.
Secretary: Dr. Wendell L. Hughes, 131 Fulton Ave., Hempstead, N. Y.
Time: 8:30 p. m., third Monday of every month from October to May, inclusive.

New York Society for Clinical Ophthalmology

President: Dr. Maurice L. Wieselthier, 117 E. 30th St., New York.
Secretary: Dr. Benjamin Esterman, 983 Park Ave., New York 28.
Place: New York Academy of Medicine, 2 E. 103d St. Time: 8 p. m., first Monday of each month from October to May, inclusive.

Oklahoma City Academy of Ophthalmology and Otolaryngology

President: Dr. James P. Luton, 117 N. Broadway, Oklahoma City.
Secretary: Dr. Harvey O. Randel, 117 N. Broadway, Oklahoma City.
Place: University Hospital. Time: Second Tuesday of each month from September to May.

Omaha and Council Bluffs Ophthalmological and Oto-Laryngological Society

President: Dr. D. D. Stonecypher, Nebraska City, Neb.
Secretary-Treasurer: Dr. W. Howard Morrison, 1500 Medical Arts Bldg., Omaha.
Place: Omaha Club, 20th and Douglas Sts., Omaha. Time: 6 p. m. dinner; 7 p. m. program; third Wednesday of each month from October to May.

Passaic-Bergen Ophthalmological Club

President: Dr. Thomas Sanfacon, 340 Park Ave., Paterson, N. J.
Secretary-Treasurer: Dr. J. Averbach, 435 Clinton Ave., Clinton, N. J.
Place: Paterson Eye and Ear Infirmary. Time: 9 p. m., last Friday of every month, except June, July and August.

Philadelphia County Medical Society, Eye Section

President: Dr. Isaac Tassman, 136 S. 16th St., Philadelphia.
Secretary: Dr. Glen Gregory Gibson, 255 S. 17th St., Philadelphia.
Time: First Thursday of each month from October to May.

Pittsburgh Ophthalmological Society

President: Dr. George H. Shuman, 351–5th Ave., Pittsburgh.
Secretary: Dr. Robert J. Billings, 509 Liberty Ave., Pittsburgh.
Place: Pittsburgh Academy of Medicine Bldg. Time: Fourth Monday of each month, except June, July, August and September.

Reading Eye, Ear, Nose and Throat Society

President: Dr. Isaac B. High, 326 N. 5th St., Reading, Pa.
Secretary: Dr. Paul C. Craig, 232 N. 5th St., Reading, Pa.
Place: Wyomissing Club. Time: 6:30 p. m., third Wednesday of each month from September to July.

Richmond Eye, Ear, Nose and Throat Society

President: Dr. Luther C. Brawner, Professional Bldg., Richmond, Va.
Secretary: Dr. Clifford A. Folkes, Professional Bldg., Richmond, Va.
Place: Westmoreland Club. Time: 6 p. m., second Monday of each month from October to May.

Rochester Eye, Ear, Nose and Throat Society

President: Dr. Frank Barber, 75 S. Fitzhugh St., Rochester, N. Y.
Secretary-Treasurer: Dr. Charles T. Sullivan, 277 Alexander St., Rochester, N. Y.

St. Louis Ophthalmic Society

President: Dr. Vincent Jones, 634 N. Grand Blvd., St. Louis.
Secretary: Dr. T. E. Sanders, 508 N. Grand Blvd., St. Louis 3.
Place: Oscar Johnson Institute. Time: Fourth Friday of each month from October to April, inclusive, except December, at 8:00 p. m.

San Antonio Ophthalmo-Oto-Laryngological Society

President: Dr. Belvin Pritchett, 705 E. Houston St., San Antonio 5, Texas.

Secretary-Treasurer: Lt. Col. John L. Matthews, AAF School of Aviation Medicine, Randolph Field, Texas.

Place: San Antonio, Brooke General Hospital, Randolph Field or San Antonio Aviation Cadet Center. Time: 7 p. m., second Tuesday of each month from October to May.

San Francisco County Medical Society, Section on Eye, Ear, Nose and Throat

Chairman: Dr. Roy H. Parkinson, 870 Market St., San Francisco.

Secretary: Dr. A. G. Rawlins, 384 Post St., San Francisco.

Place: Society's Bldg., 2180 Washington St., San Francisco. Time: Fourth Tuesday of every month except June, July and December.

Shreveport Eye, Ear, Nose and Throat Society

President: Dr. David C. Swearingen, Slattery Bldg., Shreveport, La.

Secretary-Treasurer: Dr. Kenneth Jones, Medical Arts Bldg., Shreveport, La.

Place: Shreveport Charity Hospital. Time: 7:30 p. m., first Monday of every month except July, August and September.

Spokane Academy of Ophthalmology and Oto-Laryngology

President: Dr. Clarence A. Veasey Sr., 421 W. Riverside Ave., Spokane, Wash.

Secretary: Dr. Clarence A. Veasey Jr., 421 W. Riverside Ave., Spokane, Wash.

Place: Spokane Medical Library. Time: 8 p. m., fourth Tuesday of each month except June, July and August.

Syracuse Eye, Ear, Nose and Throat Society

President: Dr. A. H. Rubenstein, 713 E. Genesee St., Syracuse, N. Y.

Secretary-Treasurer: Dr. I. H. Blaisdell, 713 E. Genesee St., Syracuse, N. Y.

Place: University Club. Time: First Tuesday of each month except June, July and August.

Toledo Eye, Ear, Nose and Throat Society

Chairman: Dr. L. C. Ravin, 316 Michigan St., Toledo 2, Ohio.

Secretary: Dr. W. W. Randolph, 1838 Parkwood Ave., Toledo, Ohio.

Place: Toledo Club. Time: Each month except June, July and August.

Toronto Academy of Medicine, Section of Ophthalmology

Chairman: Dr. W. R. F. Luke, 316 Medical Arts Bldg., Toronto, Canada.

Secretary: Dr. W. T. Gratton, 216 Medical Arts Bldg., Toronto, Canada.

Place: Academy of Medicine, 13 Queens Park. Time: First Monday of each month, November to April.

Washington, D. C., Ophthalmological Society

President: Dr. Harold M. Downey, 1740 M St. N. W., Washington, D. C.

Secretary-Treasurer: Dr. Richard W. Wilkinson, 1408 L St. N. W., Washington, D. C.

Place: Medical Society of District of Columbia Bldg., 1718 M St. N. W., Washington, D. C. Time: 7:30 p. m., first Monday in November, January, March and May.

Wilkes-Barre Ophthalmological Society

Chairman: Each member in turn.

Secretary: Dr. Samuel T. Buckman, 70 S. Franklin St., Wilkes-Barre, Pa.

Place: Office of chairman. Time: Last Tuesday of each month from October to May.

INDEX TO VOLUME 33

The asterisk (*) preceding the page number indicates an original article in the Archives. Subject entries are made for all articles. Author entries are made for original articles and society transactions. Book Reviews, Obituaries and Society Transactions are indexed under these headings in their alphabetical order under the letters B, O and S, respectively.

Abnormalities and Deformities: See Monsters; Twins; and under names of organs and regions, as Choroid; Eyes, abnormalities; Eyes, absence; Iris; Heart; Retina; etc.
Abscess: See under names of organs and regions
Accommodation and Refraction: See also Astigmatism; Glasses; Myopia; Night Blindness; Presbyopia; etc.
analysis of cases of aniseikonia, *9
changes in index of refraction in ocular media in animals subjected to action of sulfonamide compounds, 486
choline esters with mydriatic and cycloplegic action, 157, 160, 251
dibutoline sulfate; new mydriatic and cycloplegic drug, *16
dissociation of form vision and light perception in patients with amblyopia ex anopsia, 160, 252
meridional aniseikonia at oblique axes, *293
ocular defects in 60,000 selectees, *137
reply to certain criticisms of aniseikonia, 327
Acetylbetamethylcholine: See Choline and Choline Derivatives
Acetylcholine, Therapy: See under Glaucoma
Adaptometer: See Accommodation and Refraction
Adler, F. H.: Pathologic physiology of convergent strabismus; motor aspects of nonaccommodational type, *362
Aebli, R.: Meningioma of sphenoidal ridge; report of case, 86
Aeronautics: See Aviation and Aviators
Age, frequency and location of punctate opacities in 300 young crystalline lenses, *229
Alcohol, Butyl: See Butanol
etiology and treatment of tobacco-alcohol amblyopia, 81
Wood: See Methyl Alcohol
Allergy: See Anaphylaxis and Allergy
Alopecia; uveitis, with poliosis, vitiligo, alopecia and dysacousia (Vogt-Koyanagi syndrome), *281
Alpers, B. J.: Suprasellar meningiomas associated with scotomatous field defects, 415
Altitude, ocular effects of altitude flying and of deep sea diving, *173
Amaurosis: See Blindness
Amblyopia: See Blindness; Strabismus
Ametropia: See Accommodation and Refraction; Myopia
Amphetamine, temporary stimulation of emmetropic visual acuity, 413
Anaphylaxis and Allergy, allergic reaction of tears of tuberculous patients, 325
Anencephaly: See Monsters, cephalic
Anesthesia, effect of local anesthetics on healing of burns of cornea, 254
effect of yeast extracts on local anesthetic activity of cocaine, 490
general, ocular sequelae of administration; paralysis of superior rectus muscle, exophthalmos, pseudoptosis and fibrosis of inferior rectus muscle following operation for pilonidal cyst with patient under general anesthesia, *385
prevention of hemorrhagic complications in orbital anesthesia, 490
treatment of bilateral retinoblastoma (retinal glioma) surgically and by irradiation; report on progress, *429
Anesthetics: See Anesthesia
Aneurysm, retinal micro-aneurysms and punctate hemorrhages, 491
Angiodiathermy: See Arteries
Angioma of retina, 413
Aniseikonia: See Accommodation and Refraction
Anisometropia: See Accommodation and Refraction
Anomalies: See Monsters; Twins; and under names of organs and regions
Anophthalmos: See Eyes, absence
Anopsia: See Blindness
Antifreeze: See Ethylene Glycol
Anxiety; ocular war neuroses, *440
Aphakia: See Cataract, extraction
Apparatus: See also Instruments
effect of faradically induced currents on extrinsic and intrinsic ocular musculature; clinical self experiment, 489
ophthalmic prisms; corrective and metric, *381
plastic corneal bath for application of penicillin, *313
Aqueous Humor, backflow phenomena in aqueous veins of normal and of glaucomatous eyes, 161, 491
corneal healing; adhesive power of aqueous fibrin in rabbit; preliminary report, 162, 486
penetration of penicillin in rabbit eyes with normal, inflamed and abraded corneas, *43, 416
secretion-diffusion theory of intraocular fluid dynamics, 88
Arachnoiditis, optochiasmic, *68
Arc Flash Conjunctivitis: See Keratoconjunctivitis
Area Martegiani: See Vitreous Humor
Arhinencephalia: See Monsters, cephalic
Arhinia: See Monsters, cephalic
Ariboflavinosis: See Riboflavin
Arteries: See also Aneurysm; Arteriosclerosis; Blood pressure; Embolism; Thrombosis; etc.
angiodiathermy of long posterior ciliary arteries and its use in treatment of glaucoma, 409
Retinal: See Retina, blood supply
Arteriosclerosis, ocular pathology in various types of dietary deficiencies, with emphasis on arteriolar sclerosis; experimental study, 248
Ascher, K. W.: Backflow phenomena in aqueous veins of normal and of glaucomatous eyes, 161, 491
Asthenopia, meridional aniseikonia at oblique axes, *293
nonpathologic and nonrefractive in origin; treatment, 324
Astigmatism at oblique axes and binocular stereoscopic spatial localization, *116
biastigmatism, 251
meridional aniseikonia at oblique axes, *293
Atherosclerosis: See Arteriosclerosis
Athletics; trauma and ocular lesions; study in reciprocal relations, 329
Atopy: See Anaphylaxis and Allergy
Atrophy: See under names of organs and regions, as Nerves, optic; etc.
Auditory Organ: See Ear
Aviation and Aviators, effect of riboflavin on corneal vascularization and symptoms of eye fatigue in Royal Canadian Air Force personnel, 485
ocular effects of altitude flying and of deep sea diving, *173
perception of color signals by persons with color anomalies under practicing conditions, 407
quantitative test for measurement of degree of red-green color deficiency, 161
Avitaminosis: See under Vitamins; and under names of deficiency diseases

Babudieri, B.: Electron microscopic observations on bacteriolysis produced by lysozyme of tears, *449
Bacilli: See Bacteria
Bacteria: See also Meningococci; Staphylococci; Streptococci; Viruses; etc.
Abortus and Melitense Group: See Undulant Fever
Calmette-Guérin: See Tuberculosis
diplococci; penicillin therapy of infections of vitreous, *455
Granulosis: See Trachoma
Leprosy: See Leprosy
Tularense: See Tularemia
Bacteriolysis, electron microscopic observations on bacteriolysis produced by lysozyme of tears, *449
Bahn, C. A.: Ophthalmic requirements of military services; changes from Jan. 1, 1944 to Jan. 1, 1945, *245
Baldness: See Alopecia
Ball, D.: Metastatic orbital tumor with exophthalmos; report of case, 87
Ballantyne, A. J.: Retinal changes associated with diabetes and with hypertension; comparison and contrast, *97
Bannon, S. L.: Development of galactose cataract in albino rat embryo, *224
Basedow's Disease: See Goiter, exophthalmic
Bellows, J. G.: Frequency and location of punctate opacities in 300 young crystalline lenses, *229
Use of penicillin in military ophthalmology, 162
Benzedrine: See Amphetamine

Berens, C.: Ocular sequelae of administration of general anesthesia; paralysis of superior rectus muscle, exophthalmos, pseudoptosis and fibrosis of inferior rectus muscle following operation for pilonidal cyst with patient under general anesthesia, *385
Berke, R. N.: Resection of levator palpebrae muscle for ptosis with anatomic studies, *269
Bernard-Horner Syndrome: See Horner Syndrome
Bietti, G. B.: Electron microscopic observations on bacteriolysis produced by lysozyme of tears, *449
Biomicroscopy: See Glaucoma
Birge, H. L.: Ocular war neuroses, *440
Blennorrhea: See Conjunctivitis; Gonorrhea
Blepharitis: See Eyelids
Blepharoconjunctivitis: See Conjunctivitis
Blepharoplasty: See under Eyelids
Blepharoptosis: See Eyelids, ptosis
Blindness: See also Vision; etc.
Army rehabilitation program for blinded and deafened, 407
dissociation of form vision and light perception in patients with amblyopia ex anopsia, 160, 252
etiology and treatment of tobacco-alcohol amblyopia, 81
National Society for the Prevention of Blindness, Inc., 88
Night: See Night Blindness
ocular defects in 60,000 selectees, *142
suppression amblyopia, 327
Blood: See also Leukocytes
pressure, high; retinal changes associated with diabetes and with hypertension; comparison and contrast, *97, 315
Body, diffuse neurofibromatosis (von Recklinghausen's disease) involving bulbar conjunctiva; report of case, with lesions of skeletal system and skin, bodily asymmetry and intracranial involvement, *110, 250
Bogart, D. W.: Traumatic subconjunctival dislocation of lens; report of case, 85
Bonaccolto, G.: Method for extraction of subluxated lenses, 256
Bones: See also under names of bones
diffuse neurofibromatosis (von Recklinghausen's disease) involving bulbar conjunctiva; report of case, with lesions of skeletal system and skin, bodily asymmetry and intracranial involvement, *110, 250
fragility; blue scleras, brittle bones and deafness; report of afflicted family, 408

Book Reviews.
Eye, Ear, Nose and Throat Manual for Nurses; R. H. Parkinson, 484
March of Time: New York Academy of Medicine Lectures to Laity, 484
Practice of Orthoptics; G. H. Giles, 164
Technique of Fitting Contact Lenses; A. L. Anderson, 164

Boshoff, P. H.: Heterochromia sympathica, *311
Two unusual ocular tuberculomas, *209
Use of Troncoso's magnesium implant in cyclodialysis for relief of glaucoma; observations in 2 cases, *404
Bowman Membrane: See under Cornea
Brain: See also Nervous System; etc.
pathologic physiology of convergent strabismus; motor aspects of nonaccommodational type, *362
Braley, A. E.: Epidemic keratoconjunctivitis, *47
Brav, A.: Accidental vaccinia of eyelid with disciform keratitis, *67
Bronson, L. H., Jr.: Herpes simplex keratitis in malaria; clinical and experimental study, *177
Brown, A. L.: Corneal healing; adhesive power of aqueous fibrin in rabbit; preliminary report, 162
Brucellosis: See Undulant Fever
Burian, H. M.: Dissociation of form and light perception in patients with amblyopia ex anopsia, 160
honorary degree awarded by Colby College, 498
Meridional aniseikonia at oblique axes, *293
Burns, effect of chemotherapeutic agents on cell division and healing of corneal burns and abrasions in rat, 162, 248
effect of local anesthetics on healing of burns of cornea, 254
Butanol, unusual type of keratitis associated with exposure to n-butyl alcohol (butanol), *106
Butyl Alcohol: See Butanol

Cadavers; corneal graft from cadaver cornea, 486
Calhoun, A. W., celebration of one hundredth anniversary of birth of, 163
Cancer: See Tumors; and under names of organs and regions, as Choroid; etc.
Carbaminoylcholine Chloride: See Glaucoma
Carson, L. D.: Ocular effects of altitude flying and of deep sea diving, *173
Caruncle: See Lacrimal Organs
Cataract, congenital, and other anomalies following German measles in mother, 325
development of galactose cataract in albino rat embryo, *224
extraction; almost complete retinal detachment after cataract extraction; complete reattachment after glaucoma attack, 80
extraction; choice of operation for primary glaucoma combined with cataract, *265
extraction; corneal sutures in operation, 250
extraction, factors affecting hemorrhage following, *192
extraction; glaucoma after operation, 409
extraction; glaucoma due to peripheral anterior synechias after operation for cataract, *199
extraction; modification of corneal section in operation for cataract, 411
extraction; photographs of retinal detachment in aphakia before and after operation, 491
frequency and location of punctate opacities in 300 young crystalline lenses, *229
inherited, in B. genealogy; occurrence of diverse types of cataract in descendants of 1 person, *341
juvenile, in association with dermatosis, 410
polycythemia vera; extraction of both lenses, 487
Cauda Equina: See Spinal Cord
Cauterization: See under names of various diseases
Cells, effect of chemotherapeutic agents on cell division of intact and regenerating corneal epithelium in rat following burns and abrasions, 162, 248
Cellulitis: See Orbit
Cellulose; use of methyl cellulose in ophthalmology, *378
Cerebrum: See Brain
Chace, R. R.: Ophthalmic prisms; corrective and metric, *381
Chamberlain, W. P., Jr.: Herpes simplex keratitis in malaria; clinical and experimental study, *177
Chemotherapy: See under names of diseases and chemotherapeutic agents, as Conjunctivitis; Eyes, diseases; Sulfonamides; Trachoma; Tuberculosis; etc.
Chiasm, Optic: See Optic Chiasm
Children, frequency of squint, 412
trachoma in London; end of chapter, 158
treatment of bilateral retinoblastoma (retinal glioma) surgically and by irradiation; report on progress, *429
Chloroform: See Anesthesia
Choanae: See Nose
Choked Disk: See Neuritis, optic
Choline and Choline Derivatives, choline esters with mydriatic and cycloplegic action, 157, 160, 251
Therapy: See under Glaucoma
Chordoma; ophthalmologic features of intracranial chordoma and allied tumors of clivus, *397
Choroid, absence of; choroideremia; report of case, 254, *468
cancer; metastatic carcinoma of choroid; general metastasis from melanoma of abdominal wall, with paresis of external rectus muscle; rubeosis iridis, with melanoma of choroid and secondary glaucoma, 158
inflammation; gonorrheal choroiditis treated with penicillin, *406
ocular defects in 60,000 selectees, *140
Choroideremia: See Choroid, absence of
Choroiditis: See Choroid, inflammation
Ciliary Body: See Uvea
Region: See Uvea
Cinema: See Moving Pictures
Cocaine: See Anesthesia
Cogan, D. G.: Syndrome of nonsyphilitic interstitial keratitis and vestibuloauditory symptoms, *144
Unusual type of keratitis associated with exposure to n-butyl alcohol (butanol), *106
Cohen, M.: Ellice M. Alger, 319
Colby College, honorary degree awarded to Dr. Hermann M. Burian by, 498
Color Perception: See also Vision
perception of color signals by persons with color anomalies under practicing conditions, 407
quantitative test for measurement of degree of red-green color deficiency, 161
Congress: See Societies
Conjunctiva, diffuse neurofibromatosis (von Recklinghausen's disease) involving bulbar conjunctiva; report of case, with lesions of skeletal system and skin, bodily asymmetry and intracranial involvement, *110, 250
dionin effect in, 490
granulation tumor of, 158
lymphocytosis and its significance in eye diseases, 78
oculoglandular tularemia, 409

Conjunctiva—Continued
relationship between bacteriology of conjunctiva and nasal mucosa, 247
Surgery: See Glaucoma
syphilis, 247
transparency of, 485
two unusual ocular tuberculomas, *209
Conjunctivitis: See also Keratoconjunctivitis; Ophthalmia
Arc Flash: See Keratoconjunctivitis
Granular: See Trachoma
inclusion biennorrhea, 78
meningococcic, 324
Pannus: See Trachoma
Parinaud's oculoglandular syndrome due to yeast-like organism, *471
unilateral follicular, due to molluscum contagiosum, 324
unilateral membranous, with complete cast, 78
Contact Glasses: See Glasses
Contusions: See Eyes, injuries
Convergence: See Strabismus
Convulsions: See Epilepsy
Cornea, clearing of various corneal opacities; preliminary report, 408
effect of chemotherapeutic agents on cell division of intact and regenerating corneal epithelium in rat following burns and abrasions, 162, 248
effect of local anesthetics on healing of burns of, 254
effect of riboflavin on corneal vascularization and symptoms of eye fatigue in Royal Canadian Air Force personnel, 485
evaluation of results in series of transplants, 83
graft from cadaver cornea, 486
herpes corneae and virus infection, 486
Inflammation: See Keratitis; Keratoconjunctivitis
influence of local application of sulfonamide compounds and their vehicles on regeneration of corneal epithelium, *463
metabolism of, 247
Pannus: See Trachoma
penetration of penicillin in rabbit eyes with normal, inflamed and abraded corneas, *43, 416
plastic corneal bath for application of penicillin, *313
relationship of corneal vascularization to riboflavin deficiency; further studies, 324
Surgery: See also Cataract; Glaucoma
surgery; corneal healing; adhesive power of aqueous fibrin in rabbit; preliminary report, 162, 486
Syphilis: See Keratitis, interstitial
transplantation, simple technic for, *150
ulcers; treatment of serpiginous and other purulent ulcers of cornea with sodium sulfanilamide, 408
ulcers; use of tyrothricin, bacterial extract, in treatment of marginal ulcers of cornea, 328
vascularity as sign of ariboflavinosis, 155
vitreous striae and retrocorneal trabeculae following interstitial keratitis, 247
Corpora Nigra: See Iris, abnormalities
Correction in abstract of paper by Dr. William F. Hughes Jr. entitled "Chemical Burns of Eye" (Arch. Ophth. 32: 432 [Nov.] 1944), 81
in transcript of article by Dr. Carlos Weskamp entitled "Bowen's Disease of the Cornea" (Arch. Ophth. 31: 310 [April] 1944), 81
in transcript of article by Major John G. Bellows entitled "The Crystalline Lens in Diabetes Mellitus" (Arch. Ophth. 32:498 [Dec.] 1944), 264
Cowan, A.: Aberrations of eye, 418
Cranium, diffuse neurofibromatosis (von Recklinghausen's disease) involving bulbar conjunctiva; report of case, with lesions of skeletal system and skin, bodily asymmetry and intracranial involvement, *110, 250
ophthalmologic features of intracranial chordoma and allied tumors of clivus, *397
tumors; extradural diploic epidermoids producing unilateral exophthalmos, 327
Crystalline Lens: See Lens, Crystalline
Culler, A. M.: Incompatibility of silver nitrate and sulfathiazole, 317
Cushman, B.: Analysis of cases of aniseikonia, *9
Cyclodialysis: See Glaucoma
Cyclopia: See Monsters, cephalic
Cycloplegia: See Accommodation and Refraction
Cysts: See under names of organs and regions, as Pilonidal Sinus; Retina; etc.
Epidermoid: See under Cranium

Dacryocystitis: See Lacrimal Organs
Dacryocystorhinostomy: See Lacrimal Organs
Dark Adaptation: See Accommodation and Refraction
Davis, William Thornwall, postgraduate course in ocular surgery, pathology, ocular motility and orthoptics, 328
Deafness, Army rehabilitation program for blinded and deafened, 407
blue scleras, brittle bones and deafness; report of afflicted family, 408
syndrome of nonsyphilitic interstitial keratitis and vestibuloauditory symptoms, *144
uveitis, with poliosis, vitiligo, alopecia and dysacousia (Vogt-Koyanagi syndrome), *281
Deficiency Diseases: See also Scurvy; etc.
Deformities: See Monsters; Twins; and under names of organs and regions
Degeneration, hyaline; defects in visual field produced by hyaline bodies in optic disks, 317
Depth Perception: See Space, perception
Descemet Membrane: See Cornea
Detergents, reactivity of ocular tissues to wetting agents, 251
De Voe, A. G.: Surgical procedures on anophthalmic orbit, 493
Diabetes Mellitus, retinal changes associated with diabetes and with hypertension; comparison and contrast, *97, 315
Diathermocoagulation: See Cataract; Glaucoma; Retina, detachment
Diathermy: See under names of diseases, organs and regions, as Arteries; etc.
Dibutoline sulfate; new mydriatic and cycloplegic drug, *16
Dickey Operation: See Eyelids, ptosis
Diet and Dietetics: See also Rations; Vitamins
ocular pathology in various types of dietary deficiencies, with emphasis on arteriolar sclerosis; experimental study, 248
Diethylstilbestrol: See Estrogens
Di Grandi, J.: Hydrogen ion concentration of vitreous in living eye, *32
Dionin: See Conjunctiva
Diplegia: See Paralysis
Diplococci: See Bacteria
Directory of ophthalmologic societies, 89, 165, 257, 333, 421, 499
Disk, Optic: See Nerves, optic
Dislocation: See Lens, Crystalline
Diving, ocular effects of altitude flying and of deep sea diving, *173
Doryl: See Glaucoma
Downing, A. H.: Ocular defects in 60,000 selectees, *137
Drusen: See Degeneration, hyaline
Duane's Syndrome: See Eyes, movement
Dublin, G. J.: Syphilitic iritis, with reference to Herzheimer reaction as diagnostic aid and response to different methods of treatment, including penicillin therapy, 416
Duncan, H. A. G.: Plastic corneal bath for application of penicillin, *313
Dysacousia: See Deafness
Dystrophy: See under Cornea; etc.

Ear: See also Deafness
syndrome of nonsyphilitic interstitial keratitis and vestibuloauditory symptoms, *144
Ectopia: See Lens, Crystalline
Edema: See Orbit
Education, American Board of Ophthalmology, 420
American Orthoptic Council; examinations for technicians, 420
ophthalmologic seminar, Emory University School of Medicine, 88, 253
summer graduate course in ophthalmology, University of Rochester School of Medicine and Dentistry, 498
William Thornwall Davis postgraduate course in ocular surgery, pathology, ocular motility and orthoptics, 328
Eggers, H.: Estimation of uncorrected visual acuity in malingerers, *23
Electrocoagulation: See under specific headings
Electron: See Microscopy
Electrosurgery: See under specific headings
Elliot Operation: See under Glaucoma
Elwyn, H.: Retinal changes associated with diabetes and with hypertension, 315
Embolism: See also Thrombosis
of branch of central artery of retina with cure; report of 2 cases, 80
Emmetropia: See Accommodation and Refraction
Emory University School of Medicine, ophthalmologic seminar, 88, 253
Enophthalmos: See under Eyes
Enucleation: See Cataract; Eyes, surgery; Glaucoma; etc.
Epidermis: See Skin
Epidermoid Tumors: See Cranium, tumors
Epilepsy, ocular symptoms of "sacred disease" [epilepsy], 489
Episcleritis: See Sclera
Epithelium: See Cornea
Esophoria: See Strabismus
Esotropia: See Strabismus

Estrogens, endocrine treatment of keratoconjunctivitis sicca, 155
Ethylene Glycol: action of antifreeze on visual organ, 492
Evisceration: See Eyes, surgery
Exercise; visual exercises in ophthalmology, *178
Exomphalos: See Hernia, umbilical
Exophoria: See Strabismus
Exophthalmos: See also Goiter, exophthalmic
extradural diploic epidermoids producing unilateral exophthalmos, 327
meningioma of sphenoidal ridge: report of case, 86
ocular sequelae of administration of general anesthesia; paralysis of superior rectus muscle, exophthalmos, pseudoptosis and fibrosis of inferior rectus muscle following operation for pilonidal cyst with patient under general anesthesia, *385
relative effects of thiouracil, iodine and subtotal thyroidectomy on exophthalmos of hyperthyroidism, 330
secondary to edema and degenerative changes in orbital tissues, 412
with metastatic orbital tumor; report of case, 87
Exotropia: See Strabismus
Eyelids: See also Conjunctiva
accidental vaccinia of eyelid with disciform keratitis, *67
ocular sequelae of administration of general anesthesia; paralysis of superior rectus muscle, exophthalmos, pseudoptosis and fibrosis of inferior rectus muscle following operation for pilonidal cyst with patient under general anesthesia, *385
pneumoencephalocele, secondary to puncture wound of lid, 249
ptosis, acquired; classification and correction, 418
ptosis; modified sling operation for correction, *482
ptosis; post-traumatic and hysterical, 156
ptosis; resection of levator palpebrae muscle for ptosis with anatomic studies, *269
Eyes: See also Orbit; Vision; and under names of special structures and diseases
aberrations of, 418
Abnormalities: See also under names of special structures of eye
abnormalities; congenital malformations induced in rats by vitamin A deficiency, 408
absence; surgical procedures on anophthalmic orbit, 493
Accommodation and Refraction: See Accommodation and Refraction
action of antifreeze on visual organ, 492
Anesthesia: See Anesthesia
Anomalies: See under names of special structures of eye and diseases
backflow phenomena in aqueous veins of normal and of glaucomatous eyes, 161, 491
Blood Supply: See Retina, blood supply
brucellosis, *56
complications of tumors of nasopharynx, 252
Cysts: See under names of special structures of eye
defects in 60,000 selectees, *137
Diseases: See also Glaucoma; Ophthalmia; Trachoma; etc.
diseases; incidence in Australian Imperial Forces, Middle East, 155
diseases; penicillin in ophthalmology, 492
diseases, roentgen therapy of, 414
diseases; use of penicillin in military ophthalmology, 162
diseases; vitamins in ophthalmology, 253
effects of altitude flying and of deep sea diving, *173
Examination: See Accommodation and Refraction; Foreign Bodies; Vision, tests; etc.
Exercises: See Orthoptics; Strabismus
Foreign Bodies in: See Foreign Bodies
Gonorrhea: See Gonorrhea
green spot in fundus of eye, 492
Hemorrhage: See also Vitreous Humor
hemorrhage; factors affecting hemorrhage following extractions of cataracts, *192
hemorrhage; vitamin P in ophthalmology, 78
humors; secretion-diffusion theory of intraocular fluid dynamics, 80
industrial eye health problems, 248
infection of human eye with Torula histolytica, 419
Injuries: See also under Cataract; Foreign Bodies
injuries; changes in blood as symptom of threatening sympathetic ophthalmia; preliminary report, 414
injuries; effect of chemotherapeutic agents on cell division of intact and regenerating corneal epithelium in rat following burns and abrasions, 162, 248
Eyes—Continued
injuries, industrial, caused by flying objects, *152
injuries, traumatic, in soldiers, 493
manifestations due to nutritional deficiencies in Naval personnel in Southwest Pacific, 494
Movements: See also Nystagmus; Paralysis; Strabismus; etc.
movements; congenital deficiency of abduction of eyes (Duane's syndrome), 412
movements; pathologic physiology of convergent strabismus; motor aspects of nonaccommodational type, *362
Muscles: See Orthoptics; Paralysis; Phorias; Strabismus
muscles; effect of faradically induced currents on extrinsic and intrinsic ocular musculature; clinical self experiment, 489
muscles; ocular sequelae of administration of general anesthesia; paralysis of superior rectus muscle, exophthalmos, pseudoptosis and fibrosis of inferior rectus muscle following operation for pilonidal cyst with patient under general anesthesia, *385
muscles; paresis of right superior oblique and of left superior rectus muscle; differential diagnosis, 77
muscles; recession of trochlea for reducing action of superior oblique muscle, 325
muscles; resection of levator palpebrae muscle for ptosis with anatomic studies, *269
neurosis, 156
ocular biophotomicrography; preliminary report, 250
ophthalmic requirements of military services; changes from Jan. 1, 1944 to Jan. 1, 1945, *245
ophthalmologic features of intracranial chordoma and allied tumors of clivus, *397
pathology in various types of dietary deficiencies, with emphasis on arteriolar sclerosis; experimental study, 248
Paralysis: See Paralysis
penetration of penicillin in rabbit eyes with normal, inflamed and abraded corneas, *43, 416
prosthesis: surgical procedures on anophthalmic orbit, 493
reactivity of ocular tissues to wetting agents, 251
Refraction: See Accommodation and Refraction
Soviet military ophthalmology, 249
strain; effect of riboflavin on corneal vascularization and symptoms of eye fatigue in Royal Canadian Air Force personnel, 485
Surgery: See Cataract; Cornea; Glaucoma; etc.
symptoms of "sacred disease" [epilepsy], 489
Tension: See Glaucoma
total herpes zoster of ophthalmic, maxillary and mandibular divisions of trigeminal nerve; report of case in which there was also involvement of geniculate ganglion and vestibular portion of eighth cranial nerve, *237
toxoplasmosis; report of ocular findings in infant twins, *184
transplantation; functional polarization in retinal development and its reestablishment in regenerating retinae of rotated grafted eyes, 490
trauma and ocular lesions; study in reciprocal relations, 329
traumatic enophthalmos, 487
Tuberculosis: See Tuberculosis
war neuroses, *440

Factories: See under Industrial Diseases
Fatigue, Ocular: See under Eyes, strain
Fever: See Malaria; Undulant Fever; etc.
Malta: See Undulant Fever
Fibrin, corneal healing; adhesive power of aqueous fibrin in rabbit; preliminary report, 162, 486
Fibrosis: See Eyes, muscles
Flavones; vitamin P in ophthalmology, 78
Fluorescence, elementary illumination for ophthalmologist, *1, 316, 484
Fonda, G.: Ocular sequelae of administration of general anesthesia; paralysis of superior rectus muscle, exophthalmos, pseudoptosis and fibrosis of inferior rectus muscle following operation for pilonidal cyst with patient under general anesthesia, *385
Food: See Diet and Dietetics; Rations; Vitamins
Foramen Hyaloidaea: See Vitreous Humor
Foreign Bodies in eye; errors in roentgenographic diagnosis, 325
incompatibility of silver nitrate and sulfathiazole, 317
industrial injuries of eye caused by flying objects, *152
intraocular, 410
intraocular, end results of, 82

Foreign Bodies—Continued
intraocular; late results of removal with magnet, 156
management in eye, 155
nonmagnetic; removal from vitreous, 155
Fragilitas Ossium: See Bones, fragility
Fridenberg, P.: Trauma and ocular lesions; study in reciprocal relations, 329
Fundus Oculi: See under Retina
Fungi, Parinaud's oculoglandular syndrome due to yeastlike organism, *471

Galactose; development of galactose cataract in albino rat embryo, *224
Ganglion: See also Nervous System; Neurons
geniculate; total herpes zoster of ophthalmic, maxillary and mandibular divisions of trigeminal nerve; report of case in which there was also involvement of geniculate ganglion and vestibular portion of eighth cranial nerve, *237
Gas Masks: See Masks
German Measles: See Rubella
Givner, I.: Mark J. Schoenberg, 322
Ophthalmologic features of intracranial chordoma and allied tumors of clivus, *397
Glasses: See also Accommodation and Refraction
analysis of cases of aniseikonia, *9
meridional aniseikonia at oblique axes, *293
ocular effects of altitude flying and of deep sea diving (use of goggles), *173
ophthalmic prisms; corrective and metric, *381
Glaucoma after cataract operation, 409
almost complete retinal detachment after cataract extraction; complete reattachment after glaucoma attack, 80
angiodiathermy of long posterior ciliary arteries and its use in treatment of, 409
associated with nevus flammeus; report of case, *389
backflow phenomena in aqueous veins of normal and of glaucomatous eyes, 161, 491
bilateral infantile glaucoma associated with bilateral congenital hemangioma, 315
choice of operation for primary glaucoma combined with cataract, *265
due to peripheral anterior synechias after operation for cataract, *199
history and development of iris-inclusion operations, 157
macula-wedge scotoma; prognostic index in, 248
metastatic carcinoma of choroid; general metastasis from melanoma of abdominal wall, with paresis of external rectus muscle; rubeosis iridis, with melanoma of choroid and secondary glaucoma, 158
operation for, 487
pathogenesis of, *392
surgical control in Negro, 79
surgical management in correlation with gonioscopy and biomicroscopy, *358
tenotomy of rectus muscles in, 487
use of doryl (carbaminoylcholine chloride), 79
use of Troncoso's magnesium implant in cyclodialysis for relief of glaucoma; observations in 2 cases, *404
Glioma, treatment of bilateral retinoblastoma (retinal glioma) surgically and by irradiation; report on progress, *429
Goggles: See Glasses
Goiter: See also Exophthalmos; Thyroid
exophthalmic; exophthalmic ophthalmoplegia, 325
exophthalmic; exophthalmos of hyperthyroidism, 157
exophthalmic; exophthalmos of hyperthyroidism, 326
exophthalmic; progressive exophthalmos in toxic disease of thyroid gland; review of recent literature, with report of case of progressive postthyroidectomy proptosis in 6 year old Negro girl, 326
Goldberg, H. K.: Gonorrheal choroiditis treated with penicillin, *406
Gonioscopy: See Glaucoma
Gonorrhea; gonorrheal choroiditis treated with penicillin, *406
Graduate Work: See Education
Grafts: See under Cornea; Eyes; etc.
Grant, W. M.: Unusual type of keratitis associated with exposure to n-butyl alcohol (butanol), *106
Granuloma, granulation tumor of conjunctiva, 158
Grasset, E.: Two unusual ocular tuberculomas, *209
Green, M. I.: Simple technic for corneal transplantation, *150
Green spot in fundus of eye, 492
Grossmann, E. E.: Glaucoma associated with nevus flammeus; report of case, *389
Gumma: See under names of organs and regions
Gunn Phenomenon: See Jaw-Winking Phenomenon
Guyton, J. S.: Choice of operation for primary glaucoma combined with cataract, *265

Haas, J. S.: Glaucoma due to peripheral anterior synechias after operation for cataract, *199
Hair, color of; uveitis, with poliosis, vitiligo, alopecia and dysacousia (Vogt-Koyanagi syndrome), *281
Diseases: See Alopecia
Hardy, Le G. H.: Elementary illumination for ophthalmologist, *1, 316
Ophthalmic prisms; corrective and metric, *381
Harris, H. J.: Brucellosis, *56
Hartmann, E.: Optochiasmic arachnoiditis, *68
Hay Fever: See Anaphylaxis and Allergy
Head: See also Cranium
injuries; post-traumatic and hysterical ptosis, 156
Headache, mechanisms of, 488
Heart, congenital cataract and other anomalies following German measles in mother, 325
Heath, P.: Toxoplasmosis; report of ocular findings in infant twins, *184
Hemangioma; bilateral infantile glaucoma associated with bilateral congenital hemangioma, 315
Hemeralopia: See Night Blindness
Hemorrhage: See Eyes, hemorrhage; Retina, blood supply; etc.
Heparin: See Thrombosis
Heredity, inherited cataract in B. genealogy; occurrence of diverse types of cataract in descendants of 1 person, *341
Hernia, umbilical, with cyclopia completa and arhinencephalia completa in full term child; report of case, *217
Herpes corneae and virus infection, 486
simplex keratitis in malaria; clinical and experimental study, *177
zoster, total, of ophthalmic, maxillary and mandibular divisions of trigeminal nerve; report of case in which there was also involvement of geniculate ganglion and vestibular portion of eighth cranial nerve, *237
Herxheimer Reaction: See Syphilis
Hess, L.: Pathogenesis of glaucoma, *392
Heterochromia: See Iris, pigmentation
Heterophoria: See Phorias
Heterotropia: See Strabismus
Higginbottom, R. M.: Development of galactose cataract in albino rat embryo, *224
von Hippel's Disease: See Angioma; Retina
van der Hoeve Syndrome: See Bones, fragility; Deafness; Sclera
Hormones: See Estrogens; etc.
Horner Syndrome, diagnosis of localization of Claude Bernard-Horner syndrome, 411
Hull, F. H.: End results of intraocular foreign bodies, 82
Hyaline Bodies: See Degeneration, hyaline
Hyaloid Canal: See under Vitreous Humor
Hydrogen Ion Concentration of vitreous in living eye, *32
Hyperergy: See Anaphylaxis and Allergy
Hypertension: See Blood pressure, high
Hyperthyroidism: See Goiter, exophthalmic; Thyroid
Hyphemia: See Eyes, hemorrhage
Hypoderma: See Myiasis
Hypopyon: See Cornea, ulcers
Hysteria; ptosis; post-traumatic and hysterical, 156

Illumination: See Lighting
Immunity: See Anaphylaxis and Allergy; etc.
Inclusion Bodies: See Conjunctivitis, inclusion
Indians, American; trachoma, 327
Industrial Diseases: See also Mines and Miners
actinic keratoconjunctivitis, 249
elementary illumination for ophthalmologist, *1, 316, 484
industrial eye health problems, 248
industrial injuries of eye caused by flying objects, *152
trauma and ocular lesions; study in reciprocal relations, 329
unusual forms of nystagmus with review of literature, *13
unusual type of keratitis associated with exposure to n-butyl alcohol (butanol), *106
Infants, Newborn: See Newborn Infants
Premature: See Premature Infants
Inflammation, Corneal: See Keratitis
Ocular: See Ophthalmia; and under special structures of eyes
Infra-Red Therapy: See Keratoconjunctivitis
Injuries: See Trauma; and under names of organs and regions, as Cornea; Eyes; Head; etc.
Instruments: See also Apparatus
after-image perimetry; rapid method of obtaining visual fields; preliminary report, *40
hydrogen ion concentration of vitreous in living eye (measured with glass electrode), *32
new hemispheric perimeter, 255
quantitative test for measurement of degree of red-green color deficiency, 161
Quereau-Putnam tropophorometer, *28

Insulin: See Diabetes Mellitus
Intraocular Tension: See Glaucoma
Iodine and Iodine Compounds: See under Thyroid
Iridencleisis: See Glaucoma
Iris: See also Pupils
abnormalities; corpora nigra with anterior synechia, 252
diseases; ocular defects in 60,000 selectees, *139
epithelial tumors of, 327
inflammation; syphilitic iritis, with reference to Herxheimer reaction as diagnostic aid and response to different methods of treatment, including penicillin therapy, 416
leiomyoma of, 327
metastatic carcinoma of choroid; general metastasis from melanoma of abdominal wall, with paresis of external rectus muscle; rubeosis iridis, with melanoma of choroid and secondary glaucoma, 158
pigmentation; heterochromia sympathica, *311
Iritis: See Iris, inflammation
Ishihara's Tables: See Color Perception

Jaw-Winking Phenomenon; Marcus Gunn phenomenon; report of case, 407
Jaws, total herpes zoster of ophthalmic, maxillary and mandibular divisions of trigeminal nerve; report of case in which there was also involvement of geniculate ganglion and vestibular portion of eighth cranial nerve, *237

Kaan, H. W.: Development of galactose cataract in albino rat embryo, *224
Kamellin, S.: Management of paralysis of divergence, *476
Kellogg, Society of Kellogg Fellows of Pan-American Congress of Ophthalmology, 328
Keratectomies: See Cornea
Keratitis: See also Keratoconjunctivitis
accidental vaccinia of eyelid with disciform keratitis, *67
herpes simplex keratitis in malaria; clinical and experimental study, *177
Interstitial: See also Trachoma
interstitial, vitreous striae and retrocorneal trabeculae following, 247
parenchymatous, in case of acquired syphilis, 78
syndrome of nonsyphilitic interstitial keratitis and vestibuloauditory symptoms, *144
treatment of leprous sclerokeratitis, 409
Ulcerative: See Cornea, ulcers
Trachomatous: See Trachoma
unusual type associated with exposure to n-butyl alcohol (butanol), *106
Keratoconjunctivitis, actinic, 249
allergic reaction of tears of tuberculous patients, 325
epidemic, *47
infra-red therapy of flash keratoconjunctivitis, 78
sicca; endocrine treatment, 155
Keratoplasty: See under Cornea
Kiehle, F. A., resignation from staff of University of Oregon Medical School, 498
Kindred, J. E.: Cyclopia completa and arhinencephalia completa with umbilical hernia in full term child; report of case, *217
Klauder, J. V.: Syphilitic iritis, with reference to Herxheimer reaction as diagnostic aid and response to different methods of treatment, including penicillin therapy, 416
Knapp, A. A.: Ocular manifestations due to nutritional deficiencies in Naval personnel in Southwest Pacific, 494
Koyanagi-Vogt Syndrome: See under Uvea, inflammation
Krafka, J., Jr.: Cyclopia and arhinia; new concept, *128
Kronfeld, P. C.: Glaucoma due to peripheral anterior synechias after operation for cataract, *199

Lacrimal Canal: See Lacrimal Organs
Lacrimal Organs, lacrimation reflex, 249
permeabilization of lacrimal passages, 488
simplified external dacryocystorhinostomy, 156
sulfadiazine in treatment of dacryocystitis of newborn, *62
Lacrimation: See Tears
Lamina Sclerae: See Sclera
Vitrea: See Choroid
LaMotte, W. O., Jr.: Penetration of penicillin in rabbit eyes with normal, inflamed and abraded corneas, *43, 416
Laval, J.: Modified sling operation for correction of ptosis, *482
Lecture, de Schweinitz, 498
Leiomyoma of iris, 327
Lens, Crystalline, diseases; ocular defects in 60,000 selectees, *139
method for extraction of subluxated lenses, 256
Opacity: See Cataract
report on family with ectopic lenses, 250
retrolental fibroplasia in premature infants; further studies on fibroplastic overgrowth of persistent tunica vasculosa lentis, *203
traumatic subconjunctival dislocation of lens; report of case, 85
Leopold, I. H.: Influence of local application of sulfonamide compounds and their vehicles on regeneration of corneal epithelium, *463
Intravitreal penetration of penicillin and penicillin therapy of infections of vitreous, *211, 495
Penetration of penicillin in rabbit eyes with normal, inflamed and abraded corneas, *43, 416
Leprosy; treatment of leprous sclerokeratitis, 409
Leukocytes, changes in blood as symptom of threatening sympathetic ophthalmia; preliminary report, 414
Leukoma: See under Cornea
Light, actinic keratoconjunctivitis, 249
dissociation of form vision and light perception in strabismic amblyopia, 160, 252
Lighting, elementary illumination for ophthalmologist, *1, 316, 484
Limbus Conjunctivae: See under Conjunctiva
Corneae: See Cornea
Lindau's Disease: See under Angioma; Retina
Lisman, J. V.: Defects in visual field produced by hyaline bodies in optic disks, 317
Luckiesh, M.: Illumination for ophthalmologists, 316
Lutman, F. C.: Inherited cataract in B. genealogy; occurrence of diverse types of cataract in descendants of 1 person, *341
Lymph Nodes, Parinaud's oculoglandular syndrome due to yeastlike organism, *471
Lymphocytes: See also Leukocytes
count; lymphocytosis and its significance in eye diseases, 78
Lymphocytosis: See Lymphocytes, count
Lysozyme; electron microscopic observations on bacteriolysis produced by lysozyme of tears, *449

McConnell, J. M.: Development of galactose cataract in albino rat embryo, *224
Macula Lutea: See also Vision
type of foveo-macular retinitis observed in U. S. Navy, 80
Madigan, L. F.: Astigmatism at oblique axes and binocular stereoscopic spatial localization, *116
Magder, H.: Choroideremia; report of case, 254, *468
Magnesium, use of Troncoso's magnesium implant in cyclodialysis for relief of glaucoma; observations in 2 cases, *404
Magnet: See under Foreign Bodies
Malaria, herpes simplex keratitis in; clinical and experimental study, *177
Malingering; estimation of uncorrected visual acuity in malingerers, *23
Malnutrition: See Nutrition
Malta Fever: See Undulant Fever
Martin, H.: Treatment of bilateral retinoblastoma (retinal glioma) surgically and by irradiation; report on progress, *429
Masks; gas mask wafer for presbyopia, 251
Maxilla: See Jaws
Mecholyl: See Choline and Choline Derivatives; Glaucoma
Medicine: See Ophthalmology; etc.
Military: See Military Medicine
Naval: See Naval Medicine
Meibomian Glands: See Eyelids
Melanoma, encapsulated orbital melanoma, 158
metastatic carcinoma of choroid; general metastasis from melanoma of abdominal wall, with paresis of external rectus muscle; rubeosis iridis, with melanoma of choroid and secondary glaucoma, 158
Meningioma of sphenoidal ridge; report of case, 86
pigmented, and neuroepithelioma of optic nerve; report of case, 329
suprasellar, associated with scotomatous field defects, 415
Meningococci; meningococcic conjunctivitis; 324
Mercury Vapor Arc: See Keratoconjunctivitis
Methyl Alcohol; action of antifreeze on visual organ, 492
Methyl Cellulose: See Cellulose
Metric System: See Weights and Measures
Meyer, S. J.: Surgical management of glaucoma in correlation with gonioscopy and biomicroscopy, *358

Microscopy, electron microscopic observations on bacteriolysis produced by lysozyme of tears, *449
Mikulicz Disease (hypertrophy of salivary and lacrimal glands), 79
Military Medicine: See also Aviation and Aviators; Naval Medicine; Recruits; etc.
Army rehabilitation program for blinded and deafened, 407
estimation of uncorrected visual acuity in malingerers, *23
gunshot wounds of orbit, 410
herpes simplex keratitis in malaria; clinical and experimental study, *177
incidence of eye disease in Australian Imperial Forces, Middle East, 155
night blindness of war, 253
ocular neurosis, 156
ocular war neuroses, *440
ophthalmic requirements of military services; changes from Jan. 1, 1944 to Jan. 1, 1945, *245
prostheses after military trauma of orbit, 488
Soviet military ophthalmology, 249
traumatic injuries of eyes in soldiers, 493
use of penicillin in military ophthalmology, 162
Mines and Miners, simple method of demonstrating nystagmus in certain miners, 411
Minsky, A.: New hemispheric perimeter, 255
Molluscum contagiosum, unilateral follicular conjunctivitis due to, 324
Monocytes, Count: See Leukocytes
Monsters, cephalic; cyclopia and arhinia; new concept, *128
cephalic; cyclopia completa and arhinencephalia completa with umbilical hernia in full term child; report of case, *217
Morphea: See Scleroderma
Movements: See Eyes, movements
Moving Pictures, visual physiology of cinema, 79
Mucous Membrane: See under Nose
Muscles, Ocular: See Eyes, muscles; Strabismus
Paralysis: See Paralysis
Myasthenia Gravis of ophthalmoplegic type, 411
Mydriasis: See under Pupils
Myiasis, orbital, 80
Myopia, changes in index of refraction in ocular media in animals subjected to action of sulfonamide compounds, 486

Nantz, F. A.: Corneal healing; adhesive power of aqueous fibrin in rabbit; preliminary report, 162
Narcosis: See Anesthesia
Nasolacrimal Duct: See Lacrimal Organs
Nasopharynx, tumors, ocular complications of, 252
Naval Medicine: See also Aviation and Aviators; Military Medicine; Recruits; etc.
ocular manifestations due to nutritional deficiencies in Naval personnel in Southwest Pacific, 494
type of foveo-macular retinitis observed in U. S. Navy, 80
Navies: See Naval Medicine
Nearsightedness: See Myopia
Neel, J. V.: Inherited cataract in B. genealogy: occurrence of diverse types of cataract in descendants of 1 person, *341
Neff, E. E.: Factors affecting hemorrhage following extractions of cataracts, *192
Negroes; progressive exophthalmos in toxic disease of thyroid gland; review of recent literature, with report of case of progressive post-thyroidectomy proptosis in 6 year old Negro girl, 326
surgical control of glaucoma in, 79
Nerves: See also Nervous System; Neuritis; Paralysis; etc.
Cells: See Neurons
optic, atrophy; suprasellar meningiomas associated with scotomatous field defects, 415
optic; defects in visual field produced by hyaline bodies in optic disks, 317
optic, pigmented meningioma and neuroepithelioma of; report of case, 329
Paralysis: See under Paralysis
trigeminal; total herpes zoster of ophthalmic, maxillary and mandibular divisions of trigeminal nerve; report of case in which there was also involvement of geniculate ganglion and vestibular portion of eighth cranial nerve, *237
Nervous System: See also Brain; Nerves; Neurons: Reflex; Spinal Cord; etc.
diagnosis of localization of Claude Bernard-Horner syndrome, 411
heterochromia sympathica, *311
pathogenesis of glaucoma, *392
Neuritis, optic; retrobulbar neuritis; 5 cases due to paranasal sinusitis, 412
Neuroepithelioma and pigmented meningioma of optic nerve; report of case, 329
Neurofibromatosis, diffuse (von Recklinghausen's disease) involving bulbar conjunctiva; report of case, with lesions of skeletal system and skin, bodily asymmetry and intracranial involvement, *110, 250
Neurons, diagnosis of localization of Claude Bernard-Horner syndrome, 411
Neuroses and Psychoneuroses: See also Hysteria; etc.
ocular neurosis, 156
ocular war neuroses, *440
Nevi: See also Angioma
bilateral infantile glaucoma associated with bilateral congenital hemangioma, 315
glaucoma associated with nevus flammeus; report of case, *389
Newborn Infants, cyclopia completa and arhinencephalia completa with umbilical hernia in full term child; report of case, *217
sulfadiazine in treatment of dacryocystitis of newborn, *62
Night Blindness of war, 253
Night Vision: See Accommodation and Refraction
Nose: See also Nasopharynx
Accessory Sinuses: See Sinuses, Nasal
relationship between bacteriology of conjunctiva and nasal mucosa, 247
Nutrition: See also Diet and Dietetics; Vitamins
ocular manifestations due to nutritional deficiencies in Naval personnel in Southwest Pacific, 494
Nyctalopia: See Night Blindness
Nystagmus, optic; ocular defects in 60,000 selectees, *138
simple method of demonstrating nystagmus in certain miners, 411
unusual forms with review of literature, *13

Obituaries:
Alger, Ellice M., 319
Butler, Thomas Harrison, 321
Imre, Joseph, 497
Schoenberg, Mark J., 322

Occipital Bone, ophthalmologic features of intracranial chordoma and allied tumors of clivus, *397
Occupational Diseases: See Industrial Diseases
O'Connor Cinch Operation: See Strabismus
Oculogyric Crises: See Eyes, movements
Ogle, K. N.: Astigmatism at oblique axes and binocular stereoscopic spatial localization, *116
Meridional aniseikonia at oblique axes, *293
Oguchi's Disease: See Night Blindness
Ointments, influence of local application of sulfonamide compounds and their vehicles on regeneration of corneal epithelium, *463
O'Neill, H.: Total herpes zoster of ophthalmic, maxillary and mandibular divisions of trigeminal nerve; report of case in which there was also involvement of geniculate ganglion and vestibular portion of eighth cranial nerve, *237
Ophthalmia: See also Conjunctivitis; Eyes, diseases; Keratoconjunctivitis
changes in blood as symptom of threatening sympathetic ophthalmia; preliminary report, 414
Egyptian: See Trachoma
Gonorrheal: See Gonorrhea
Ophthalmologic societies, directory of, 89, 165, 257, 333, 421, 499
Ophthalmology, elementary illumination for ophthalmologist, *1, 316, 484
Teaching: See under Education
use of methyl cellulose in, *378
visual exercises in, *478
Ophthalmomyiasis: See Myiasis
Ophthalmoplegia: See Paralysis
Optic Chiasm, optochiasmic arachnoiditis, *68
Optic Disk; Optic Papilla: See Nerves, optic; Neuritis, optic
Optic Tract: See Nerves, optic
Orbit, anophthalmic, surgical procedures on, 493
cellulitis treated successfully with penicillin, 157
encapsulated melanoma, 158
exophthalmos secondary to edema and degenerative changes in orbital tissues, 412
gunshot wounds of, 410
meningioma of sphenoidal ridge; report of case, 86
metastatic tumor with exophthalmos; report of case, 87
myiasis, 80
plastic spheres for implantation into Tenon's capsule in Frost-Lang type operation for enucleation of eyeball, 489
prevention of hemorrhagic complications in orbital anesthesia, 490
prostheses after military trauma of, 488
recession of trochlea for reducing action of superior oblique muscle, 325

Orthoptics: See also Strabismus
American Orthoptic Council; examinations for technicians, 253, 420
duties and training of orthoptic technician, 325
essential requirements for good orthoptic department, 412
visual exercises in ophthalmology, *478
Osteogenesis Imperfecta: See Bones, fragility
Oxygen; metabolism of cornea, 247
Ozanics, V.: Effect of chemotherapeutic agents on cell division of intact and regenerating corneal epithelium in rat following burns and abrasions, 162

Páez Allende, F.: Diffuse neurofibromatosis (von Recklinghausen's disease) involving bulbar conjunctiva; report of case, with lesions of skeletal system and skin, bodily asymmetry and intracranial involvement, *110, 250
Palsy: See Paralysis
Pannus: See Trachoma
Papilledema: See Neuritis, optic
Paracentesis: See Eyes, surgery
Paralysis, choice of fixating eye in paralytic and nonparalytic strabismus, 156
congenital paralysis of both external recti treated by transplantation of eye muscles, 489
correction of external-rectus paralysis with contracture of opposing internus, 80
exophthalmic ophthalmoplegia, 325
management of paralysis of divergence, *476
metastatic carcinoma of choroid; general metastasis from melanoma of abdominal wall, with paresis of external rectus muscle; rubeosis iridis, with melanoma of choroid and secondary glaucoma, 158
myasthenia gravis of ophthalmoplegic type, 411
ocular defects in 60,000 selectees, *138
ocular sequelae of administration of general anesthesia: paralysis of superior rectus muscle, exophthalmos, pseudoptosis and fibrosis of inferior rectus muscle following operation for pilonidal cyst with patient under general anesthesia, *385
ophthalmologic features of intracranial chordoma and allied tumors of clivus, *397
ophthalmoplegia and retinal degeneration, 80
paresis of right superior oblique and of left superior rectus muscle; differential diagnosis, 77
Parasites: See Myiasis
Parinaud's Disease: See under Conjunctivitis
Pascal, J. I.: Illumination for ophthalmologist, 484
Visual exercises in ophthalmology, *478
Paton, R. T.: Evaluation of results in series of corneal transplants, 83
Thrombosis of central vein treated with heparin, 255
Penicillin, intravitreal penetration of penicillin and penicillin therapy of infections of vitreous, *211, 495
penetration in rabbit eyes with normal, inflamed and abraded corneas, *43, 416
plastic corneal bath for application of, *313
Therapy: See Choroid, inflammation; Eyes, diseases; Orbit; Syphilis; Vitreous Humor; etc.
Perception: See Color Perception; Space, perception
Perera, C. A.: Pigmented meningioma and neuroepithelioma of optic nerve; report of case, 329
Perimeter, new hemispheric, 255
Perimetry: See Vision
Perry, I. H.: Infection of human eye with Torula histolytica, 419
*p*H: See Hydrogen Ion Concentration
Phlyctenulosis: See under Conjunctiva
Phorias, divergence excess considered as anomaly of postural tonus of muscular apparatus, 326
Quereau-Putnam tropophorometer, *28
Photography: See Retina
Photomicrography: See Eyes
Pilonidal Sinus; ocular sequelae of administration of general anesthesia; paralysis of superior rectus muscle, exophthalmos, pseudoptosis and fibrosis of inferior rectus muscle following operation for pilonidal cyst with patient under general anesthesia, *385
Plastic Surgery: See Surgery, plastic
Pneumocephalus; pneumoencephalocele, secondary to puncture wound of lid, 249
Pneumoencephalocele: See Pneumocephalus
Poisons and Poisoning: See under names of substances, as Methyl Alcohol; etc.
Poliosis: See Hair, color of
Polycythemia vera: extraction of both lenses, 487
Postgraduate Education: See Education
Pregnancy, congenital cataract and other anomalies following German measles in mother, 325
congenital malformations of eyes induced in rats by vitamin A deficiency, 408
Premature Infants, retrolental fibroplasia in; further studies on fibroplastic overgrowth of persistent tunica vasculosa lentis, *203
Presbyopia, gas mask wafer for, 251
Pressure: See Blood, pressure
Prisms, Ophthalmic: See Glasses
Proptosis: See Goiter, exophthalmic
Prosthesis: See under Eyes; Orbit
Pseudoisochromatic Test: See Color Perception
Pseudoptosis: See Eyelids
Psychoses: See Neuroses and Psychoneuroses
Ptosis: See Eyelids, ptosis
Pupils, choline esters with mydriatic and cycloplegic action, 157, 160, 251
dibutoline sulfate; new mydriatic and cycloplegic drug, *16
Tonic: See under Reflex
Putnam, O. A.: Quereau-Putnam tropophorometer, *28
Putnam-Quereau tropophorometer, *28

Quereau, J. Van D.: Quereau-Putnam tropophorometer, *28
Quereau-Putnam tropophorometer, *28

R. C. A. F.: See Aviation and Aviators
Races: See Indians, American; Negroes; etc.
Radiations: See Roentgen Rays
Therapy: See Retinoblastoma
Rand, G.: Elementary illumination for ophthalmologist, *1, 316
Rations, ocular manifestations due to nutritional deficiencies in Naval personnel in Southwest Pacific, 494
Recklinghausen's Disease: See Neurofibromatosis
Reconditioning: See Rehabilitation
Recruits: See also Military Medicine
estimation of uncorrected visual acuity in malingerers, *23
ocular defects in 60,000 selectees, *137
Reese, A. B.: Treatment of bilateral retinoblastoma (retinal glioma) surgically and by irradiation; report on progress, *429
Reflex, lacrimation reflex, 249
pathogenesis of glaucoma, *392
pathologic physiology of convergent strabismus; motor aspects of nonaccommodational type, *362
pupillary; simple method for early diagnosis of abnormalities of pupillary reaction, 326
Refraction: See Accommodation and Refraction
Rehabilitation: See also Military Medicine; Neuroses and Psychoneuroses; Recruits; etc.
Army rehabilitation program for blinded and deafened, 407
Respirators: See Masks
Retina: See also Macula Lutea
abnormalities; congenital folds, 78
angioma of, 413
Blood Supply: See also Aneurysm; Arteriosclerosis; Thrombosis; etc.
blood supply; retinal micro-aneurysms and punctate hemorrhages, 491
changes associated with diabetes and with hypertension; comparison and contrast, *97, 315
degeneration, and ophthalmoplegia, 80
detachment, almost complete, after cataract extraction; complete reattachment after glaucoma attack, 80
detachment photographs in aphakia before and after operation, 491
detachment; trauma and ocular lesions; study in reciprocal relations, 329
green spot in fundus of eye, 492
ocular defects in 60,000 selectees, *140
rupture of cyst causing retinal detachment, 327
treatment of bilateral retinoblastoma (retinal glioma) surgically and by irradiation; report on progress, *429
Retinoblastoma, treatment of bilateral retinoblastoma (retinal glioma) surgically and by irradiation; report on progress, *429
Retinoscopy: See Accommodation and Refraction
Riboflavin: See also Vitamins, B
corneal vascularity as sign of ariboflavinosis, 155
effect on corneal vascularization and symptoms of eye fatigue in Royal Canadian Air Force personnel, 485
metabolism of cornea, 247
relationship of corneal vascularization to riboflavin deficiency; further studies, 324
Riesenman, F. R.: Unusual forms of nystagmus with review of literature, *13
Roentgen Rays, errors in roentgenographic diagnosis of foreign bodies in eye, 325
Therapy: See under names of organs and regions, as Eyes, diseases; etc.
Rones, B.: Traumatic injuries of eyes in soldiers, 493

Rosen, E.: Bilateral infantile glaucoma associated with bilateral congenital hemangioma, 315
Uveitis, with poliosis, vitiligo, alopecia and dysacousia (Vogt-Koyanagi syndrome), *281
Rubella, congenital cataract and other anomalies following German measles in mother, 325
Rubrophen: See Tuberculosis
Rucker, C. W.: Defects in visual field produced by hyaline bodies in optic disks, 317

Sacred Disease: See Epilepsy
Samuels, B.: Thomas Harrison Butler, 321
Sarcoma: See under names of organs and regions
Schlezinger, N. S.: Suprasellar meningiomas associated with scotomatous field defects, 415
Schools, trachoma in London; end of chapter, 158
de Schweinitz lecture, annual, 498
Sclera, blue, brittle bones and deafness; report of afflicted family, 408
Surgery: See under Cataract; Glaucoma
treatment of leprous sclerokeratitis, 409
Scleroderma, juvenile cataract in association with dermatosis, 410
Sclerosis: See Arteriosclerosis
Scotoma, macula-wedge scotoma; prognostic index in glaucoma, 248
suprasellar meningiomas associated with scotomatous field defects, 415
Screw Worms: See Myiasis
Scrofula: See Tuberculosis
Seeing Eye Dog: See Blindness
Selectees: See Recruits
Sella Turcica, suprasellar meningiomas associated with scotomatous field defects, 415
Sheppard, Ernest, appointment of, 328
Shevky, M. C.: Infection of human eye with Torula histolytica, 419
Silver nitrate; incompatibility of silver nitrate and sulfathiazole, 317
Simpson, G. V.: Sulfadiazine in treatment of dacryocystitis of newborn, *62
Sinus, Nasal: See Sinuses, Nasal
Sinuses, Nasal; retrobulbar neuritis; 5 cases due to paranasal sinusitis, 412
Sjögren Syndrome: See Keratoconjunctivitis
Skeleton: See Bones
Skin, diffuse neurofibromatosis (von Recklinghausen's disease) involving bulbar conjunctiva; report of case, with lesions of skeletal system and skin, bodily asymmetry and intracranial involvement, *110, 250
Diseases: See Herpes; etc.
Skull: See Cranium
Sling Operation: See Eyelids
Slit-Lamp: See Foreign Bodies
Sloan, L. L.: Quantitative test for measurement of degree of red-green color deficiency, 161
Smallpox, accidental vaccinia of eyelid with disciform keratitis, *67
Smelser, G. K.: Effect of chemotherapeutic agents on cell division of intact and regenerating corneal epithelium in rat following burns and abrasions, 162
Effect of local anesthetics on healing of burns of cornea, 254
Smith, H. C.: Unusual forms of nystagmus with review of literature, *13
Smith, J. W.: Paresis of right superior oblique and of left superior rectus muscle; differential diagnosis, 77
Societies, American Board of Ophthalmology, 420
Association for Research in Ophthalmology; cancellation of annual meeting, 328
Canadian Ophthalmological Society, 420
Central Illinois Society of Ophthalmology and Otolaryngology, 420
foreign, directory of, 89, 165, 257, 333, 421, 499
international, directory of, 89, 165, 257, 333, 421, 499
local, directory of 93, 169, 261, 337, 425, 503
national, directory of, 90, 166, 258, 334, 422, 500
National Society for Prevention of Blindness, Inc., 88
ophthalmologic, directory of, 89, 165, 257, 333, 421, 499
Pan-American Congress of Ophthalmology, 163, 328
sectional, directory of, 91, 167, 259, 335, 423, 501
Society of Kellogg Fellows of Pan-American Congress of Ophthalmology, 328
state, directory of, 91, 167, 259, 335, 423, 501

Society Transactions:
Association for Research in Ophthalmology, Inc., 160
College of Physicians, Philadelphia, Section on Ophthalmology, 415, 495
New York Academy of Medicine, Section on Ophthalmology, 82, 254, 329, 493
Space, perception; astigmatism at oblique axes and binocular stereoscopic spatial localization, *116
Spaeth, E. B.: Acquired ptosis; classification and correction, 418
Spectacles: See Glasses
Sphenoid Bone, meningioma of sphenoidal ridge; report of case, 86
ophthalmologic features of intracranial chordoma and allied tumors of clivus, *397
Spinal Cord: See also Nervous System; etc.
compression; unusual forms of nystagmus with review of literature, *13
Sports: See Athletics
Squint: See Strabismus
Staphylococci, penicillin therapy of infections of vitreous, *455
Steele, W. H.: Influence of local application of sulfonamide compounds and their vehicles on regeneration of corneal epithelium, *463
Stereopsis: See Vision, stereoscopic
Sternberg, P.: Surgical management of glaucoma in correlation with gonioscopy and biomicroscopy, *358
Stow, M. N.: Relative effects of thiouracil, iodine and subtotal thyroidectomy on exophthalmos of hyperthyroidism, 330
Strabismus, choice of fixating eye in paralytic and nonparalytic strabismus, 156
convergent concomitant squint; operations on 100 cases, 156
dissociation of form vision and light perception in strabismic amblyopia, 160, 252
frequency of squint, 412
ocular defects in 60,000 selectees, *138
pathologic physiology of convergent strabismus; motor aspects of nonaccommodational type, *362
phenomena associated with eccentric fixation, 251
Quereau-Putnam tropophorometer, *28
simple test for binocular fixation, 159
suppression amblyopia, 327
Streptococci, unilateral membranous conjunctivitis with complete cast, 78
Sturm's Interval: See Astigmatism
Sulfadiazine: See Lacrimal Organs; Sulfonamides
Sulfanilamide: See Cornea; Sulfonamides; Trachoma; etc.
Sulfathiazole: See Sulfonamides
Sulfonamides, changes in index of refraction in ocular media in animals subjected to action of sulfonamide compounds, 486
incompatibility of silver nitrate and sulfathiazole, 317
influence of local application of sulfonamide compounds and their vehicles on regeneration of corneal epithelium, *463
Therapy: See Cornea; Eyes, diseases; Lacrimal Organs; Trachoma; Undulant Fever; etc.
Surgery: See also Apparatus; Instruments; and under organs and diseases, as Cornea; Eyelids; Eyes; Glaucoma; etc.
plastic; Soviet military ophthalmology, 249
Sutures: See Cataract, extraction; Eyes, muscles; etc.
Swan, K. C., appointment to staff of University of Oregon Medical School, 498
Choline esters with mydriatic and cycloplegic action, 157, 160, 251
Dibutoline sulfate; new mydriatic and cycloplegic drug, *16
Use of methyl cellulose in ophthalmology, *378
Syphilis: See also under names of organs, regions and diseases, as Conjunctiva; etc.
acquired, parenchymatous keratitis in case of, 78
syphilitic iritis, with reference to Herxheimer reaction as diagnostic aid and response to different methods of treatment, including penicillin therapy, 416

Tears: See also Lacrimal Organs
allergic reaction of tears of tuberculous patients, 325
electron microscopic observations on bacteriolysis produced by lysozyme of tears, *449
lacrimation reflex, 249
Technicians: See Orthoptics
Temporomaxillary Joint: See Jaws
Tenon's Capsule: See Orbit
Tenotomy: See Glaucoma
Tension: See Glaucoma
Terry, T. L.: Retrolental fibroplasia in premature infants; further studies on fibroplastic overgrowth of persistent tunica vasculosa lentis, *203
Theodore, F. H.: Parinaud's oculoglandular syndrome due to yeastlike organism, *471
Theron, J. J.: Heterochromia sympathica, *311
Thiouracil: See Thiourea
Thiourea, relative effects of thiouracil, iodine and subtotal thyroidectomy on exophthalmos of hyperthyroidism, 330

Thrombosis: See also Embolism
arteriolar, of retina, 251
of central vein treated with heparin, 255
Thyroid: See also Goiter
hyperthyroidism, exophthalmos of, 157
relative effects of thiouracil, iodine and subtotal thyroidectomy on exophthalmos of hyperthyroidism, 330
Thyroidectomy, relative effects of thiouracil, iodine and subtotal thyroidectomy on exophthalmos of hyperthyroidism, 330
Thyrotoxicosis: See Goiter, exophthalmic
Tinnitus; syndrome of nonsyphilitic interstitial keratitis and vestibuloauditory symptoms, *144
Tisher, P. W.: Industrial injuries of eye caused by flying objects, *152
Tissue: See Cells
Tobacco; etiology and treatment of tobacco-alcohol amblyopia, 81
Torula, infection of human eye with Torula histolytica, 419
Torulosis: See Torula
Toxoplasmosis; report of ocular findings in infant twins, *184
Trachoma, 327
in London; end of chapter, 158
morbidity of, 491
sulfanilamide in treatment, 413
Transplantation: See under Cornea
Trauma: See also under Cataract; Cornea; Eyes; Face; Head; Myopia; etc.
and ocular lesions; study in reciprocal relations, 329
traumatic subconjunctival dislocation of lens; report of case, 85
Trochlea: See Orbit
Troncoso's Implant: See Glaucoma
Tropophorometer of Quereau-Putnam, *28
Tuberculoma; two unusual ocular tuberculomas, *209
Tuberculosis: See also under special structures of eye and names of diseases
allergic reaction of tears of tuberculous patients, 325
of eye, chemotherapy; report of cases, 487
Tularemia, oculoglandular, 409
Tumors: See also Angioma; Chordoma; Hemangioma; Leiomyoma; Melanoma; Meningioma; Neuroepithelioma; Tuberculoma; etc.; and under names of organs and regions, as Conjunctiva; Cranium; Iris; Nasopharynx; Orbit; etc.
metastasis: metastatic carcinoma of choroid; general metastasis from melanoma of abdominal wall, with paresis of external rectus muscle; rubeosis iridis, with melanoma of choroid and secondary glaucoma, 158
Tunica Vasculosa Lentis: See Lens, Crystalline
Twins, toxoplasmosis; report of ocular findings in infant twins, *184
Tyrothricin: See Cornea

Ulcers, Corneal: See under Cornea
Undulant Fever; brucellosis, *56
Uvea, inflammation; uveitis, with poliosis, vitiligo, alopecia and dysacousia (Vogt-Koyanagi syndrome), *281
Uveitis: See Uvea, inflammation

Vaccinia: See Smallpox
van der Hoeve Syndrome: See Bones, fragility
Varicella: See Chickenpox
Variola: See Smallpox
Vasa Hyaloidea Propria: See Vitreous Humor
Veins, Aqueous: See Aqueous Humor
Retinal: See Retina, blood supply; Thrombosis
Vertigo, syndrome of nonsyphilitic interstitial keratitis and vestibuloauditory symptoms, *144
Viruses, herpes corneae and virus infection, 486
Vision: See also Accommodation and Refraction; Blindness; etc.
after-image perimetry; rapid method of obtaining visual fields; preliminary report, *40
Color: See Color Perception
Defective: See also Astigmatism; Myopia; Phorias; etc.
defective; ocular defects in 60,000 selectees, *137
defects in visual field produced by hyaline bodies in optic disks, 317
Vision—Continued
dissociation of form vision and light perception in strabismic amblyopia, 160, 252
estimation of uncorrected visual acuity in malingerers, *23
new hemispheric perimeter, 255
ophthalmic requirements of military services; changes from Jan. 1, 1944 to Jan. 1, 1945, *245
physiology; functional polarization in retinal development and its reestablishment in regenerating retinae of rotated grafted eyes, 490
stereoscopic; astigmatism at oblique axes and binocular stereoscopic spatial localization, *116
suprasellar meningiomas associated with scotomatous field defects, 415
Tests: See also Accommodation and Refraction; Color Perception; Night Blindness; Phorias; etc.
tests; industrial eye health problems, 248
tests; simple test for binocular fixation, 159
tests; temporary stimulation of emmetropic visual acuity, 413
visual exercises in ophthalmology, *478
visual physiology of cinema, 79
Vitamins: See also Riboflavin
A; congenital malformations of eyes induced in rats by vitamin A deficiency, 408
A; metabolism of cornea, 247
B: See also Riboflavin
B; etiology and treatment of tobacco-alcohol amblyopia, 81
B_2: See Riboflavin
in ophthalmology, 253
P: See Flavones
Vitiligo; uveitis, with poliosis, vitiligo, alopecia and dysacousia (Vogt-Koyanagi syndrome), *281
Vitreous Humor, hydrogen ion concentration in living eye, *32
intravitreal penetration of penicillin and penicillin therapy of infections of vitreous, *211, 495
ocular defects in 60,000 selectees, *140
penicillin therapy of infections of, *455
removal of non-magnetic foreign body from, 155
vitreous striae and retrocorneal trabeculae following interstitial keratitis, 247
Vogt-Koyanagi Syndrome: See Uvea, inflammation
von Sallmann, L.: Hydrogen ion concentration of vitreous in living eye, *32
Penicillin therapy of infections of vitreous, *455

Wald, G.: Dissociation of form and light perception in patients with amblyopia ex anopsia, 160
War: See also Aviation and Aviators; Military Medicine; Naval Medicine; etc.
night blindness of, 253
Weights and Measures, ophthalmic prisms; corrective and metric, *381
Weiss, B. P.: Suprasellar meningiomas associated with scotomatous field defects, 415
Weiss, C.: Infection of human eye with Torula histolytica, 419
Welding: See Industrial Diseases
Wetting Agents: See Detergents
Wheeler, M. C.: Ophthalmic prisms; corrective and metric, *381
White, N. G.: Choline esters with mydriatic and cycloplegic action, 157, 160, 251
Dibutoline sulfate; new mydriatic and cycloplegic drug, *16
Wilder, H.: Traumatic injuries of eyes in soldiers, 493
Wiley, M.: Intravitreal penetration of penicillin and penicillin therapy of infections of vitreous, *211
Williamson, W. P.: After-image perimetry; rapid method of obtaining visual fields; preliminary report, *40
Wounds: See also Military Medicine; War
Gunshot: See Orbit

Yeast: See also Fungi
effect of yeast extracts on local anesthetic activity of cocaine, 490

Zona: See Herpes
Zuelzer, W. W.: Toxoplasmosis; report of ocular findings in infant twins, *184